M-TECH z

(STRUCTURAL ENGINEERING)

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

DEPARTMENT OF CIVIL ENGIEERING
INDUS INSTITUTE OF TECHNOLOGY AND ENGINEERING
INDUS UNIVERSITY

M-TECH (STRUCTURAL ENGINEERING), SEMESTER–I TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2016

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	ST101	Theory Of Elasticity And Plasticity	3	2	0	4	5	30	10	60	-	-	100
2	ST102	Advanced Structural Dynamics	3	2	0	4	5	30	10	60	-	-	100
3	ST103	Advanced Design Of Concrete Structures	3	2	0	4	5	30	10	60	-	-	100
4	ST104	Advanced Structural Analysis	3	2	0	4	5	30	10	60	-	-	100
5	ST105	Soil Dynamics And Foundation Engineering	3	0	2	4	5	30	10	60	40	60	200
6	Ref Annex - I	Major Elective-I	3	2	0	4	5	30	10	60	-	-	100
7	ST106	Seminar-I	0	4	0	2	4	30	10	60	-	-	100
TOTAL			**18**	**14**	**2**	**26**	**34**	**270**	**70**	**420**	**40**	60	**800**

ANNEX–I (ELECTIVE–I)

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	ST107	Advanced Materials (Composites)	3	2	0	4	5	30	10	60	-	-	100
2	ST108	Numerical Methods In Engineering	3	2	0	4	5	30	10	60	-	-	100
3	ST109	Computer Programming	3	2	0	4	5	30	10	60	-	-	100

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4	ST110	Optimization Techniques In Structural Engineering	3	2	0	4	5	30	10	60	-	-	100

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INDUS UNIVERSITY

M-TECH (STRUCTURAL ENGINEERING), SEMESTER–II TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2016

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	ST201	Advanced Design Of Steel Structures	3	2	0	4	5	30	10	60	-	-	100
2	ST202	Earthquake Engineering	3	0	2	4	5	30	10	60	40	60	200
3	ST203	Finite Element Analysis	3	2	0	4	5	30	10	60	-	-	100
4	ST204	Tall Structures	3	2	0	4	5	30	10	60	-	-	100
5	ST205	Computer Aided Structural Analysis And Design	0	0	4	2	4	-	-	-	40	60	100
6	Ref Annex - II	Major Elective-II	3	2	0	4	5	30	10	60	-	-	100
7	ST206	Seminar-II	0	4	0	2	4	30	10	60	-	-	100
8	ST207	Research Methodology	1	0	0	0	1	30	10	60	-	-	100
TOTAL			**16**	**12**	**6**	**24**	**34**	**210**	**70**	**420**	**80**	**120**	**900**

ANNEX–II (ELECTIVE–II)

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	ST208	Experimental Stress Analysis	3	0	2	4	5	30	10	60	-	-	100
2	ST209	Repair And Rehabilitation Of Structures	3	2	0	4	5	30	10	60	-	-	100
3	ST210	Bridge Engineering	3	2	0	4	5	30	10	60	-	-	100

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

4	ST211	Prestressed Concrete Structures	3	2	0	4	5	30	10	60	-	-	100
5	ST212	Theory Of Plates & Shells	3	2	0	4	5	30	10	60	-	-	100

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INDUS INSTITUTE OF TECHNOLOGY AND ENGINEERING
INDUS UNIVERSITY

M-TECH (STRUCTURAL ENGINEERING), SEMESTER–III TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017

SR NO	CODE	SUBJECTS	TOTAL CREDITS	TEACHING SCHEME (HOURS)			EXAMINATION SCHEME						TOTAL
							INTERNAL			EXTERNAL			
				L	T	P	REPORT	VIVA-VOCE	PRESENTATION	REPORT	VIVA-VOCE	PRESENTATION	
1	ST0301	Dissertation Phase – I	20	-	-	40	50	50	50	50	50	50	300
TOTAL			20	-	-	40	50	50	50	50	50	50	300

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INDUS INSTITUTE OF TECHNOLOGY AND ENGINEERING
INDUS UNIVERSITY

M-TECH (STRUCTURAL ENGINEERING), SEMESTER –IV TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017														
SR NO	CODE	SUBJECTS	TOTAL CREDITS	TEACHING SCHEME (HOURS)			EXAMINATION SCHEME						TOTAL
							INTERNAL			EXTERNAL			
				L	T	P	REPORT	VIVA-VOCE	PRESENTATION	REPORT	VIVA-VOCE	PRESENTATION	
1	ST0401	Dissertation Phase – II	20	-	-	40	50	50	50	50	50	50	300
TOTAL			20	-	-	40	50	50	50	50	50	50	300

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

Department of Civil Engineering, IITE,

Indus University

1st Semester

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

M-TECH (STRUCTURAL ENGINEERING), SEMESTER –I TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2016														
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME						
								THEORY			PRACT		TOTAL	
			L	T	P			CIE		ESE	CIE	ESE		
								MID	IE					
1	ST101	Theory Of Elasticity And Plasticity	3	2	0	4	5	30	10	60	-	-	100	
2	ST102	Advanced Structural Dynamics	3	2	0	4	5	30	10	60	-	-	100	
3	ST103	Advanced Design Of Concrete Structures	3	2	0	4	5	30	10	60	-	-	100	
4	ST104	Advanced Structural Analysis	3	2	0	4	5	30	10	60	-	-	100	
5	ST105	Soil Dynamics And Foundation Engineering	3	0	2	4	5	30	10	60	40	60	200	
6	Ref Annex - I	Major Elective-I	3	2	0	4	5	30	10	60	-	-	100	
7	ST106	Seminar-I	0	4	0	2	4	30	10	60	-	-	100	
TOTAL			**18**	**14**	**2**	**26**	**34**	**210**	**70**	**420**	**40**	**60**	**800**	

ANNEX–I (ELECTIVE–I)													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
			L	T	P			CIE		ESE	CIE	ESE	
								MID	IE				
1	ST107	Advanced Materials (Composites)	3	2	0	4	5	30	10	60	-	-	100
2	ST108	Numerical Methods In Engineering	3	2	0	4	5	30	10	60	-	-	100
3	ST109	Computer Programming	3	2	0	4	5	30	10	60	-	-	100
4	ST110	Optimization Techniques In Structural Engineering	3	2	0	4	5	30	10	60	-	-	100

Subject: **Theory Of Elasticity And Plasticity**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST101**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[14]**

Introduction, Forces, stresses and strains (Three dimensional) plane stress and plane strain problem, cauchy`s strain displacement relations, generalised Hook`s law - navier`s equilibrium conditions-compatibility- Boundary conditions – Belttrami – Michell compatibility equation.

UNIT 2 **[12]**

Airy's stress function-Saint Venant's principle. Boundary value problems in two-dimensional and three dimensional elasticity.

Two dimensional stresses – strain problems in Cartesian co-ordinates. Solution of simply supported and Cantilever beams by polynomials

UNIT 3 **[14]**

Polar Co-ordinates. Prandtl's theory of torsion. Membrane analogy, Edge Dislocation - Biharmonic equations-Stresses in circular disc - uniqueness of solution- Betti and Maxwell's reciprocity Theorems-concentrated load action on vortex of wedge (Mitchell's Problem)-concentrated load action on the free surface of a plate (Filament's problem) - stress concentration due to circular hole in stressed plate (Kirsch's problem).

UNIT 4 **[14]**

Introduction to plasticity, plastic behaviour of solids, stress / strain diagram for structural solids.

Yield criteria and flow rules – strain hardening – plastic analysis of structures – unloading from elastic – plastic states.

Text Books

1. Filonenko M., "Theory of Elasticity" Borodich Dover Publication, New York, USA, 2000.

Reference books

1. Timoshenko S P and Goodier J N, "Theory of Elasticity", MC Graw Hill Book Co., Inc., New York , USA, 2004.
2. Venkatraman B & Patel S A., "Structural Mechanics with Introduction to Elasticity and Plasticity", MC Graw Hill Publication, New York, USA, 2006.
3. Volterra E. & Gaines J H, "Advanced Strength of Materials", Prentice Hall Publication, New York, USA, 2000.
4. Wang C T "Applied Elasticity" Mc Graw Hill Publication, NY, USA , 2000.

Subject: **Advanced Structural Dynamics**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST102**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[15]**

Introduction to Dynamics – cause and effect of vibration, various types of pulses of vibration, single degree of freedom with and without damping, Free and forced vibration. Types of damping, viscous damping, critically damped system. Response of harmonic excitation, Dynamic equilibrium equation and solution, damping factor. Eigen value, Introduction to Relley Ritz method, Dynamics related to Earthquake excitation.

Introduction to Multi Degree freedom system – idealization of actual problem, continuous mass v/s Lumped mass, natural frequencies and mode shapes. Introduction to modal analysis.

UNIT 2 **[13]**

Dynamics of beams – Resonance dynamically sensitive structure – flexural vibration of uniform beams; Bernoulli – Euler Theorem, natural frequencies and mode shapes for five different end conditions of beams. Importance of first mode, and higher mode for various field problems. Dhumel integral.

UNIT 3 **[13]**

Approximate formula for quick determination of natural frequencies and mode shape for – beam, plate – square, circular. Solution of field problem using Richart chart for permissible amplitude, IS code permissible limit. Problem of Ultra high frequencies machine. Orientation of machine on floor.

UNIT 4 **[13]**

Introductions to Wind induced vibration of Tall chimney, damping, Von-karman street formation, Strouhal number, vortex shedding frequency, Galloping of cable

Text Books:

1. Clough R W &Penzien J., "Dynamics of Strucutres", MC Graw Hill, Inc., New York, 1993.

Reference books:

1. Paz Mario "Structural Dynamics "Mac Grawhillinc, 2004.
2. Chopra A K – "Dynamics of structures" Theory Application to earthquake engineering", Prentice Hall of India Pvt Ltd., New Delhi, 1988.
3. Anderson J S and Bratos – Anderson, on "Solving problems in vibrations", Longman scientific and technical, Harlow, 1987.

Subject: **Advanced Design Of Concrete Structures**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST103**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[15]**

Pile Foundation: Loads on pile groups, Design of a Pile, Design of pile Cap.

Raft Foundation: Types of Raft, Design of Solid Raft for Shear and Flexure.

UNIT 2 **[13]**

Flat slabs: Proportioning, analysis by direct design method and equivalent frame method, flat slab design and detailing.

Grid floors: Analysis and design by Rankine Grashoff Method, classical equivalent plate theory and IS:456 methods.

UNIT 3 **[13]**

Multi Storied Frame Buildings: Determination of dead load, live load, wind load and earthquake load on various components of the buildings and appropriate design. Detailing of reinforcement and bar bending schedule.

UNIT 4 **[13]**

Underground Liquid Retaining Structures: Introduction to IS: 3370. Determination of dead load, live load, soil pressure and earthquake loads. Design of side walls and base slab by IS codes (coefficient method). Design of side walls and base slab by analytical method.

TEXT BOOKS

1. Jain & Jaikrishna, “Plain & Reinforced Concrete Structures, vol.- I & II”, Memchand & Bros, 12/e/1999.

REFERENCE BOOKS

1. N. Krishna Raju, “Advanced Reinforced Concrete Design”, CBS Publications, 1/e/1986.
2. Varghese A V,”Limit State Design of Reinforced Concrete”, Prentice Hall of India,1/e/2002.
3. Varghese A V,” Advanced Reinforced Concrete”, Prentice Hall of India.
4. IS Codes: IS-456, IS-875, IS-1893, IS-4326, IS-13920, IS:3370.

Subject: **Advanced Structural Analysis**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST104**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[15]**

Introduction to matrix methods of analysis - static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations - for truss element, beam element and tensional element. Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates..

UNIT 2 **[13]**

Assembly of stiffness matrix from element stiffness matrix - direct stiffness method - general procedure - bank matrix - semi bandwidth - computer algorithm for assembly by direct stiffness matrix method.

UNIT 3 **[13]**

Analysis of plane truss - continuous beam - plane frame and grids by flexibility methods. Analysis of plane truss - continuous beam - plane frame and grids by stiffness methods.

UNIT 4 **[13]**

Special analysis procedures - static condensation and sub structuring - initial and thermal stresses. Shear walls- Necessity - structural behaviour of large frames with and without shear walls - approximate methods of analysis of shear walls.

Reference Books:

1. Matrix Analysis of Frames structures by William Weaver J.R and James M.Geve, CBS publications.
2. Advanced Structural Analysis by Ashok.K.Jain, New Channel Brothers.
3. Structural Analysis by C.S.Reddy.
4. Matrix Structural Analysis by Kanchi.
5. Matrix Methods of Structural Analysis by J.Meek.
6. Structural Analysis by Ghali and Neyveli.

Subject: **Soil Dynamics And Foundation Engineering**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST105**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	30/60	30/60	20/40	20/40	200

COURSE CONTENT

UNIT 1 **[15]**

Dynamic Soil Properties: Determination of dynamic soil properties.(Field and Laboratory test),Stress Strain behaviour of cyclically loaded soil, Estimation of shear modulus, Application of dynamic soil tests, Cyclic plate load test, Cyclic stress ratio, Cyclic resistance ratio, CRR correlations with SPT,CPT, Mass Spring Dash Pot System.
Liquefaction: Concept of Liquefaction, Initiation of Liquefaction, Evaluation of Liquefaction, Liquefaction hazards, Exercises on Liquefaction problems.

UNIT 2 **[13]**

Machine Foundation: Necessity, M/C foundation and its types, Basic Terminology connected with vibrating system and Foundation, General Criteria for design of Foundation, Use of Mass spring Analogy to Machine Foundation, Determination of natural frequency of Foundation soil system, Design criteria for Reciprocating and Impact Machine as per I.S code. Vibration Isolation and control, Numerical.

Liquefaction: Liquefaction related phenomena, Evaluation of liquefaction hazard, Initiation of liquefaction, Effects of liquefaction.

UNIT 3 **[13]**

Beams on Elastic Foundation: Idealized soil, foundation and interface behavior, Elastic models of soil behavior; Elastic-plastic and time dependent behavior of soil, Beams and plates on elastic foundation; numerical analysis of beams and plates resting on elastic foundation.
Geotechnical Design of Raft Foundation: Introduction to Raft Foundation, Safe Bearing pressure for Mat Foundation on clay and sand, Design of Mat foundation by Rigid method and Elastic Method.

Pile Capacity: Single Pile, Pile Group, Laterally loaded piles and deflection, Pile cap design.

UNIT 4 **[13]**

Ground Improvement Techniques: Need for ground improvement, Different types of problematic soil, Classification of Ground Improvement Techniques and their suitability to different types of soil.

Mechanical Stabilisation: Shallow and Deep compaction requirements, Principles and methods of soil compaction, Shallow compaction and methods, Deep compaction and vibratory methods, Dynamic compaction

Hydraulic Modification: Introduction and its types

Modification by admixtures: Cement, Lime, Bitumen stabilization Grouting and types of grouting, Soil Nailing and Rock Anchoring

Case studies on Ground Improvement Techniques.

Reference Books:

1. Joseph Bowles ”Foundation Analysis and Design”, McGraw- Hill Book Company.
2. V.N.S Murthy “Advanced Foundation Engineering , CBS Publishers and Distributers.
3. Braja M Das”Principles of Foundation Engineering, PWS Publishing Company.

Subject: **Seminar**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST106**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
0	0	4	2	-	30/60	-	20/40	100

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Subject: **Advanced Materials (Composites)**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST107**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[15]**

Fibre reinforced plastic composites, unidirectional composites, micromechanics, macro mechanics, prediction of elastic properties.

UNIT 2 **[13]**

Inplane analysis of laminates, Introduction to bending of laminates strength of composite materials, Introduction to sandwich structures.

UNIT 3 **[13]**

Design of structures using composite materials. Rehabilitation and strengthening of distressed structures using fibre reinforces laminates.

UNIT 4 **[13]**

Behaviour of Conventional concrete incorporating steel, glass, jute, asbestos fibres

References:

1. Holmes M & Just D J, “GRP in Structural Engineering”, App. Sci. Pub. London, 1983.
2. Tsai S. W. & H. T. Halin, Introducing to Composite Materials, Technomic Publishing Co. Inc. 1980.

Subject: **Numerical Methods In Engineering**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST108**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[15]**

Error analysis, types of errors, accuracy & precision, stability in numerical analysis. Solution of non – linear equations, Newton – Raphson iterative method, Least-Squares Regression: Linear Regression, Polynomial Regression

UNIT 2 **[13]**

Revision of Finite Differences and Interpolation, Spline Interpolation: Linear splines, quadratic splines and cubic splines. Finite difference method for solving Elliptic equations and Parabolic equations.

UNIT 3 **[13]**

Euclidean n-space, Inner product space: Definition and properties, Norms and Distance, properties of matrix, Solution of Eigen value problems, power method. Applications to Structural Dynamic problems, stress problems, buckling of columns.

UNIT 4 **[13]**

Series solutions of Differential equation: Power series method, Frobenius method, Legendre polynomial, Rodrigue's formula, generating function, recurrence relation, orthogonal property, Bessel's equation, generating function, recurrence relation.

REFERENCES:

1. Numerical methods in Engineering Salvadori & Baron.
2. Numerical Methods in Finite Element Analysis Bathe & Wilson.
3. Advanced Mathematics Kresysig.
4. Numerical Analysis Scarborough.
5. Numerical methods for scientific and engineering computations. M.K.Jain-S.R.K.Iyengar –R.K.Jain Willey Eastern Limited.
6. Numerical methods by S.S.Shastry.
7. Applied numerical analysis by – Curtis I.Gerala- Addission Wasley – published campus.
8. Numerical methods for Engineers Stevan C.Chopra, Raymond P.Canal Mc. Graw Hill book company.

Subject: **Computer Programming**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST109**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[15]**

Introduction to Programming Language

What is programming? Problem solving methods with examples-Algorithm and Flowchart, Types of Programming languages ,Characteristics of higher level language, Some Programming languages.

Introduction to 'C'

Introduction, Importance of C, Sample C programs, Basic structure of C programs, Programming style, executing a C program.

Introduction, Character Set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of Variables, Defining symbolic constants

Operators and Expression:

Introduction, Arithmetic of Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of expressions, Precedence of arithmetic operators, Type conversions in expressions, Mathematical function.

UNIT 2 **[13]**

Decision Making Statements

Introduction, Decision making with IF statement, Simple IF statement, the IF ELSEstatement, Nesting of IF … ELSE statements, The ELSE IF ladder, The switch statement, the turnery (? :) Operator, the GOTO statement.

Computer Programming

WHILE statement, the DO statement, The FOR statement, Jumps in loops Break and continue.

Array & Handling of Character strings

Introduction, One-dimensional arrays, Two-dimensional arrays, Initialization of two dimensional arrays, Concept of Multidimensional arrays. Introduction, Declaring and initializing string variables, Reading string from terminal, Writing string to screen, Arithmetic operations on characters, Putting string together, String Operations : String Copy, String Compare, String Concatenation and String Length, String Handling functions, Table of strings

UNIT 3 **[13]**

User-Defined Functions :

Introduction, Need for user-defined functions, Return values and their types, Calling a function, category of functions, No arguments and no return values, Arguments with return values, Handling of non-integer functions, Nesting of functions, Recursion, Functions with arrays, The scope and Lifetime of variables in functions.

Pointers:

Introduction, Understanding pointers, Accessing the address of variable, Declaring and initializing pointers, Accessing a variable through its pointer, Pointer expressions, Pointer increments and scale factor, Pointers and arrays, Pointers and character strings, Pointers and Functions, Pointers and structures

UNIT 4 **[13]**

Structures and Unions:

Introduction, Structure definition, Giving values to members, Structure initialization, Comparison of structures, Arrays of structures, Arrays within structures, Structures within Structures, Structures and functions, Unions.

Introduction to Object Oriented Concepts & Programming

Review of fundamental concepts of Object-oriented programming,

Introduction to C++, class and objects, Functions in C++,Constructors & Destructors

REFERENCES:

1. Programming in ANSI C, by Balagurusamy, Publisher - Tata McGraw Hill.
2. Object-oriented programming with C++,E.Balagurusamy, 2nd Edition, TMH.
3. Introduction to C by Reema Thareja, Publisher-Oxford.
4. Programming with ANSI and Turbo C, by Ashok N Kamthane, Publisher – Pearson Education.
5. Let us C, by Yashwant Kanitkar, Publisher – BPB Publication.

Subject: **Optimization Techniques In Structural Engineering**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST110**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[15]**

Introduction to Optimization: Introduction - Historical developments - Engineering applications of Optimization - Statement of an Optimization problem - Classification of Optimization problems - Optimization Techniques. Optimization by calculus: Introduction - Unconstrained functions of a single variable - Problems involving simple constraints - Unconstrained functions of several variables - treatment of equality constraints - Extension to multiple equality constraints - Optimization with inequality constraints - The generalized Newton-Raphson method..

UNIT 2 **[13]**

Linear Programming: Introduction - Applications of linear programming - standard form of a linear programming problem - Geometry of linear programming problems - Definitions and theorems - Solution of a system of Linear simultaneous equations - Pivotal reduction of a general system of equations - Motivation of the Simplex Method - Simplex Algorithm - Two phases of the simplex method. non-Linear Programming: Introduction - Unimodal Function - Unrestricted search - Exhaustive search - Dichotomous search - Interval Halving method - Fibonacci method - Golden section method - Comparison of elimination methods - Unconstrained optimization techniques - Direct search methods - Random search method - grid search method - Univariate method - Powell's method - Simplex method - Indirect search methods - Gradient of a function - Steepest descent method - Conjugate gradient - Newton's method.

UNIT 3 **[13]**

Dynamic Programming: Introduction - Multistage decision processes - concept of sub-optimization and the principle of optimality - computational procedure in dynamic programming - example illustrating the Calculus method of solution - example illustrating the Tabular of solution - conversion of a final value problem into an initial value problem - continuous dynamic programming - Additional applications.

UNIT 4 **[13]**

Network Analysis: Introduction - Elementary graph theory - Network variables and problem types - Minimum-cost route - Network capacity problems - Modification of the directional sense of the network. Application of Optimization techniques to trusses, Beams and Frames.

REFERENCES:

1. Optimization: Theory and Applications by S.S.Rao.
2. Numerical Optimization Techniques for Engineering Design with applications by G.N.Vanderplaats.
3. Elements of Structural Optimization by R.T.Haftka and Z.Gurdal.
4. Optimum Structural Design by U.Kirsch.
5. Optimum Design of Structures by K.I.Majid.
6. Introduction to Optimum Design by J.S.Arora.

Department of Civil Engineering, IITE,

Indus University

2nd Semester

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

M-TECH (STRUCTURAL ENGINEERING), SEMESTER –II TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2016													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	ST201	Advanced Design Of Steel Structures	3	2	0	4	5	30	10	60	-	-	100
2	ST202	Earthquake Engineering	3	0	2	4	5	30	10	60	40	60	200
3	ST203	Finite Element Analysis	3	2	0	4	5	30	10	60	-	-	100
4	ST204	Tall Structures	3	2	0	4	5	30	10	60	-	-	100
5	ST205	Computer Aided Structural Analysis And Design	0	0	4	2	4	-	-	-	40	60	100
6	Ref Annex - II	Major Elective-II	3	2	0	4	5	30	10	60	-	-	100
7	ST206	Seminar-II	0	4	0	2	4	30	10	60	-	-	100
8	ST207	Research Methodology	1	0	0	0	1	30	10	60	-	-	100
TOTAL			**16**	**12**	**6**	**24**	**34**	**210**	**70**	**420**	**80**	**120**	**900**

ANNEX – I I (ELECTIVE – II)													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	ST208	Experimental Stress Analysis	3	0	2	4	5	30	10	60	-	-	100
2	ST209	Repair And Rehabilitation Of Structures	3	2	0	4	5	30	10	60	-	-	100
3	ST210	Bridge Engineering	3	2	0	4	5	30	10	60	-	-	100
4	ST211	Prestressed Concrete Structures	3	2	0	4	5	30	10	60	-	-	100

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

5	ST212	Theory Of Plates & Shells	3	2	0	4	5	30	10	60	-	-	100

Subject: **Advanced Design Of Steel Structures**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST201**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[15]**

Introduction: Design requirements and design process, Material behaviour, mechanical properties under static load, fatigue failure under repeated load, brittle fracture under impact load, Dead loads, imposed loads, wind loads, earthquake load, earth or ground water load, indirect forces and combination of loads.

UNIT 2 **[13]**

Plastic Design: Plastic design of continuous beams, Rigid jointed portal frames

Multi storey building: Introduction, loading, Analysis and design for gravity and lateral forces like wind load, earthquake loads.

UNIT 3 **[13]**

Design of connections: Bolted and welded connections. Semi rigid and rigid beam-column and beam-beam connections. Beam and column splices. Moment resisting connection, Design of base plates.

UNIT 4 **[13]**

Cable Suspended Structures: Concepts, tensile structures, bridges.

Load calculations and design of steel truss Bridges for roadways including seismic performance.

REFERENCES:

1. Design of Steel Structure - Dayarathnam, P., A.H.Wheeler, 1990.
2. Design of Steel Structures – N. Subrhamanyan, Oxford.
3. Steel Structure -Design and Behaviour, Salmon, C.G., and Johnson, J.E.Harper and Row, 1980.
4. Steel Design for Structural Engineers - Kuzamanovic, B.O. and Willems,N., Prentice Hall, 1977.
5. Steel Structures - William McGuire, Prentice Hall, Inc., Englewood Cliffs, N.J.1986.

Subject: **Earthquake Engineering**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST202**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT 1 **[15]**

Introduction to Earthquake Engineering: Engineering Seismology – Earthquake phenomenon – Causes and effectsof earthquakes –Failures of structures in past earthquakes and lessons learnt– Faults Structure of earth – Plate Tectonics – ElasticRebound Theory – Earthquake Terminology – Source, Focus, Epicenteretc – Earthquakesize – Magnitude and intensity of earthquakes – Classification of earthquakes – Seismic waves –Seismic zones – Seismic Zoning Map of India – Seismograms and Accelerograms.

UNIT 2 **[13]**

Codal Design Provisions: Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy –Assumptions – Analysis of multi storied building by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion.

Codal Detailing Provisions: Review of the latest Indian codes IS: 4326 and IS: 13920 Provisions for ductile detailing of R.C buildings – Beam, column and joints.

UNIT 3 **[13]**

Aseismic Planning: Plan Configurations – Torsion Irregularities – Re-entrant corners – Nonparallelsystems – Diaphragm Discontinuity – Vertical Discontinuities inload path – Irregularity in strength and stiffness – Mass Irregularities –Vertical Geometric Irregularity – Proximity of Adjacent Buildings.

UNIT 4 **[13]**

Earthquake Resistant design of masonry building: Identification of damages and no-damages in masonry building from past earthquakes, lesson learnt, Elastic properties of structural masonry, lateral load analysis of masonry building, Design of masonry building.

REFERENCES:

1. Elements of earthquake engineering - Jaikrishna & Chandrasekaran.
2. Earthquake Resistant Design of Structures – Pankaj Agarwal & Manish Shrikhande

Subject: **Finite Element Analysis**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST203**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT – 1: **[15]**

Introduction: Concepts of FEM - steps involved - merits and demerits - energy principles – discrimination - Raleigh - Ritz method of functional approximation. Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT – 2: **[13]**

One dimensional FEM: Stiffness matrix for beam and bar elements - shape functions foe ID elements. Two dimensional FEM: Different types of elements for plane stress and plane strain analysis - displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices.

UNIT – 3: **[13]**

Isoparametric formulation: Concept - different isoparametric elements for 2D analysis - formulation of 4- noded and 8-noded isoparametric quadrilateral elements - Lagrange elements - serendipity elements. Axi Symmetric Analysis: bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements. Three dimensional FEM: Different 3-D elements-strain-displacement relationship – formulation of hexahedral and isoparametric solid element.

UNIT – 4: **[13]**

Introduction to Finite Element Analysis of Plates: basic theory of plate bending - thin plate theory - stress resultants - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element. Introduction to non – linear analysis – basic methods – application to Special structures.

REFERENCES:

1. Concepts and Applications of Finite Element Analysis by Robert D.Cook, David S. Malkus and Michael E. Plesha, John Wiley & Sons.
2. Finite element Methods by OC Zienkiewicz.
3. Finite element analysis, theory and progarmming by GS Krishna Murthy.
4. Introduction to Finite element Method by Tirupathi Chandra Patila and Belugunudu.
5. Introduction to Finite element Method by JN Reddy.

Subject: **Tall Structures**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST204**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT – 1: **[15]**

Structural Systems and concepts: Introduction to various lateral load resisting structural systems for tall buildings.

UNIT – 2: **[13]**

Loading on Tall buildings: Gravity loads, **Wind load:** Design considerations, Vortex shedding, Codal provisions - Gust effect factor, Wind-Tunnel Test, Building drifts, Human response to wind-induced building motions.

UNIT – 3: **[13]**

Seismic Design: Characteristic of a dynamic problem, Portal frame subjected to ground motion, Earthquake excitation, Response spectrum method, Seismic design consideration: Seismic response of building.

UNIT – 4: **[13]**

Overall buckling analysis of frames, wall-frames and second order effects of gravity loading, P-Delta analysis.

Reference Books:

1. Schuellar, W "High Rise Building Structures".
2. B.S. Taranath "Structural Analysis & Design of tall Buildings".
3. M. Fintal "Handbook of Concrete Structures".
4. B. Stafford Smith & A. Coule "Tall Building Structures: Analysis & Design"
5. "Advances in Tall Buildings", CBS Publishers and Distributors Delhi, 1986

Subject: **Computer Aided Structural Analysis And Design**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST205**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT – 1: **[15]**

Introduction: Introduction to Staad pro., analysis methodology, detail information regarding the software.

Modelling of reinforced concrete framed Building in STAAD Pro. : Modelling of multi-storey building, property assignment to the structure, and application of loads: Dead Load, Live Load, Wind Load and Earthquake Load.

Analysis and design of the multi-storey building: Design of various components of framed structure viz. Beam, Column, Shear wall. Concept of economical design. Detailing of Structural members viz. Slab, Beam, Column, Footing, Shear wall.

UNIT – 2 **[13]**

Modelling of Structural Steel Industrial building: Modelling of Industrial building, property assignment to the structure and application of loads: Dead Load, Live Load, Wind Load crane load and Earthquake Load.

Analysis and design of Structural Steel Industrial building: Design of various components viz. Beams, Columns, Gantry girder and Bracings. Concept of economical design.

UNIT – 3: **[13]**

Modelling of reinforced concrete framed building in ETABS: Modelling of multi-storey building, property assignment to the structure, and application of loads: Dead Load, Live Load, Wind Load and Earthquake Load.

Analysis and design of the multi-storey building in ETABS: Design of various components of framed structure viz. Beam, Column, Shear wall. Concept of economical design. Detailing of Structural members viz. Slab, Beam, Column, Footing, Shear wall, Comparison of Staad Pro and & ETABS results.

UNIT – 4: **[13]**

Introduction to SAFE, analysis methodology, detail information regarding the software.
Design of Combined footing and Raft foundations in SAFE

Subject: **Seminar-II**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST206**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

Subject: **Research Methodology**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST207**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT – 1: **[15]**

Introduction: Introduction of Research Methodology; Importance of Research in Decision Making; Defining Research Problem and Formulation of Research Problem; Research design – Exploratory, Descriptive, Experimental.

UNIT – 2: **[13]**

Data Collection and Measurement: Method and Techniques of Data Collection-Primary data (Collection through communication, Designing Questionnaire), Qualitative Research-Projective Techniques. Sampling and Sampling Designs; Attitude Measurement and Scales.

UNIT – 3: **[13]**

Data Presentation and Analysis: Data Processing; Univariate and Bivariate Analysis- Correlational Analysis- ANOVA, Analysis of Associations (Chi-Square Analysis); Multivariate Analysis and Data; Model Building and Decision Making.

UNIT – 4: **[13]**

Report Writing and Presentation: Substance of Reports; Report Writing and Presentation; Presentation of a Report

Subject: **Experimental Stress Analysis**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST208**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT – 1: **[15]**

MEASUREMENTS & EXTENSOMETER: Principles of measurements, Accuracy, Sensitivity and range of measurements. Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

UNIT – 2: **[13]**

ELECTRICAL RESISTANCE STRAIN GAUGES: Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation cross sensitivity, Rosette analysis, Wheastone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.
Load application and measurement, machines, optical and other gauges.

UNIT – 3: **[13]**

PHOTOELASTICITY: Two dimensional photo elasticity, Concept of light – photoelastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

UNIT – 4: **[13]**

BRITTLE COATING AND MOIRE METHODS: Introduction to Moire techniques, brittle coating methods and holography. Introduction to LVDT, Testing ofRCC Slab, Beam & Steel Beams.

REFERENCES:

1. Dally J W and Riley W F., "Experimental Stress Analysis, MC graw Hil, 1965.
2. Dove R C and Adams P H., "Experimental Stress Analysis and Motion Measurements", C E Merrill books, 1964.
3. Frocht M M, "Photoelasticity", J Wiley, 1941.
4. Perry and Lisner "Strain Gauge Primer", Elsevier Publication, 1992.
5. Shrinath L S & others, "Experimental Stress Analysis" Tata Mc Graw Hill Publication, 1996.

Subject: **Repair And Rehabilitation Of Structures**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST209**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT – 1: **[15]**

CAUSES FOR DISTRESS IN STRUCTURE: Philosophy & definition, causes of failure, failure in ancient time & recent times. Deficiency in design drag, material production, maintenance etc. Failure related problems; Man-made and natural failure or damage. Diagnosis of failure; change in appearance on an exposure, chemical deterioration, Mechanical deterioration. Cracking in buildings. Failure of flat roofs, balconies, trenches, dams, piles abutments piers, silos, chimney, cooling towers, R.C.C. frames, Failure information & Analysis. Format of investigation& assessment of structures. Shear, Torsion compression failure, Erection difficulty, failure in tanks silos, space frame, precast assemblies pre-stressed concrete structure, formwork failure, case studies.

UNIT – 2: **[13]**

MAINTENANCE & REPAIR OF STRUCTURES: Need for maintenance and repairs Inspection of Structures for repairs and maintenance methods for repairs, Material and methodology for repairs, Cost of repair & maintenance, Repair to foundation columns, piles, floor, roof and walls.

REHABILITATION OF DISTRESS STRUCTURES: Inspection and testing distressed structures, Techniques for rehabilitation of concrete structures, Introduction to retrofitting techniques.

UNIT – 3: **[13]**

STRUCTURE ASSESSMENT & LEGAL ASPECTS: Art of structure assessment, Method of testing – NDTs in detail, IS code for testing, Safety assessment, Legal aspects in connection to failure an repair.

UNIT – 4: **[13]**

PREVENTIVE MEASURES FOR DURABILITY OF STRUCTURES: Proper selection and specification for material, The use of modern techniques for construction, Proper design, Better workmanship.

REFERENCES:

1. Ted Kay "Assessment and Renovation of Concrete Structures" ed., John Wiley & Sons, Inc. New York., 1992.
2. Rakshit K. S. "Construction Maintenance & Repair of Highway Bridges", 1994.
3. Champion S., “Failure & Repair of Concrete Structures” Wiley Publishers, 1961.
4. Grass F K, Clarke J L & Armer GST., “Structural Assessment”, Butter Worths Publisher, 1987.
5. Raiker R N, “Learning from failures”.

Subject: **Bridge Engineering**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST210**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT – 1: **[15]**

Introduction: History of Bridges; Components of a Bridge and its definitions. Classification of road bridges, related structures, span-length. Classical examples of each type. People involved in the total process; History of Analysis.

Selection of site and initial decision process: Survey and Alignment. Geotechnical Investigations and Interpretations.

River Bridge: Selection of Bridge site and planning. Collection of bridge design data. Hydrological calculation. Waterway calculation, scour calculation, depth of foundation and freeboard.

Road Bridge: Selection of bridge site and planning. Collection of bridge design data. Vertical clearance.

UNIT – 2: **[13]**

Standard Loading for Road bridges: IRC, BS code, AASHTO code. Dead load, Live load,Impact factor, Centrifugal force. Wind loads, hydraulic forces, Longitudinal forces, Seismic forces, Earth pressure. Buoyancy, Lane concept, equivalent loads, traffic load, Width of Roadway and Footway.I.L. for statically indeterminate structures.Transverse distribution of Live loads among deck longitudinal.Load combinations for different working state andlimit state designs.

UNIT – 3: **[13]**

Superstructures: Selection of main bridge parameters, design methodologies. Choices of superstructure types, Grillage analysis. Different types of superstructure (RCC and PSC), Longitudinal Analysis and design of Solid slab Bridge, T-Girder Beam and Box Girder.

Typical details: Slab Bridge, Slab-Girder Bridge (Straight/Skew), Box Girder Bridge (Straight/ Skew).

UNIT – 4: **[13]**

Substructure: Pier, Abutment, Wing walls, Importance of Soil-Structure Interaction, Types of foundations: Open foundation, Pile foundation, Well foundation. Bending theory for pile cap and force distribution from pier to pile cap.

Bearing and deck joints: Different types of bridge bearings and expansion Joints, Design of bearings and joints**.**

REFERENCES:

1. V.K. RAINA , "Concrete Bridge Practice, Analysis, Design andEconomics", Tata McGraw-Hills Publishing Company Limited.
2. S. PONNUSWAMY , "Bridge Engineering", Tata McGraw – HillsPublishing Company Limited.
3. R. RAJAGOPALAN, "Bridge Superstructure", Tata McGraw- HillsPublishing Company Limited.

4. M. G. ASWANI, V.N.VAZIRANI, M.M. RATWANI , "Design of ConcreteBridges", Khanna Publishers.
5. M.J. RYALL, G.A.R PARKE, J.E. HARDING, "The Manual of BridgeEngineering", Thomas Telford Publishers.

Subject: **Prestressed Concrete Structures**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST211**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	50/100

COURSE CONTENT

UNIT – 1 **[15]**

Basic Concept of Prestressing, Need for High Strength Steel and Concrete, Advantages of Prestressed Concrete, Applications of Prestressed Concrete, Materials for Prestressed Concrete: High-Strength Concrete, High-Tensile Steel

Introduction to Prestressing Systems, Tensioning Devices, Pretensioning Systems, Post-Tensioning Systems, Thermo-Electric Prestressing, Chemical Prestressing

Analysis of Prestress and Bending Stresses, Basic Assumptions, Analysis of Prestress, Resultant Stresses at a Section, Pressure Line or Thrust Line and Internal Resisting Couple, Concept of Load Balancing, Stresses in Tendons, Cracking Moment.

Losses of Prestress, Loss Due to Elastic Deformation of Concrete, Loss Due to Shrinkage of Concrete, Loss Due to Creep of Concrete, Loss Due to Relaxation of Stress in Steel, Loss Due to Anchorage Sleep, Loss of Stress Due to Friction, Total Losses Allowed for Design.

UNIT – 2: **[13]**

Deflection of Prestress Concrete Members, Factors Influencing Deflections, Short Term Deflections of Uncracked Members, Effect of Tendon Profile on Deflections, Deflections Due to Self-Weight and Imposed Loads, Prediction of Long Time Deflections, Deflection of Cracked Members, Requirements of various codes of practice

Flexural Strength of Prestressed Concrete Sections, Simplified Code Procedures (IS:1343-1980), Shear and Principle Stresses, Ultimate Shear Resistance of Prestress Concrete Members, Design of Shear Reinforcement as per IS:1343-1980.

UNIT – 3: **[13]**

Philosophy of Limit-State Design, Limit State Design Criteria for Prestressed Concrete Members, Design Loads and Strengths, Partial Factors for Loads.
Design of Prestressed Concrete Sections: Design of Section for Flexure, Design of Section for Axial Tension, Design of Section for Compression and Bending, Design of Section for Shear and Torsion.

UNIT – 4: **[13]**

Prestressed Concrete Bridges: Advantages of Prestressed Concrete Bridges, Pretensioned Prestressed Concrete Bridge Decks, Post-tensioned Prestressed Concrete Bridge Decks, Design of Post-tensioned Prestressed Concrete Slab Bridge Deck. Design of Post-tensioned Prestressed Concrete T-beam Slab Bridge Deck.

TEXT BOOKS:

1. N. Krishna Raju, 'Prestressed Concrete', Tata Mc Graw Hill Publishing Co. Ltd, New Dehi.
2. Praveen Nagarajan, 'Prestressed Concrete Design', Pearson Publication.

REFERENCES BOOKS:

1. S K Mallick, A P Gupta, Prestressed concrete, Oxford and IBI Series.
2. R. H. Evans, Bennet E W, Prestressed concrete theory and design, Chapman and Hall, London.
3. T. Y. Lin, Design of Prestressed Concrete Structures, Asia Publishing House.

Subject: **Theory Of Plates & Shells**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST212**			Semester: **I**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	-	4	30/60	-	20/40	-	100

COURSE CONTENT

UNIT – 1: **[15]**

Plates: Introduction, classification, plate equation for rectangular and circular (thin) plates, Naier's solution, Lery's solution plates with various boundary conditions, geometrics and loading.

UNIT – 2: **[13]**

Application to bridge decks and water tanks design. Energy method, numerical method finite difference, fine element method.

UNIT – 3: **[13]**

Shells: Introduction, classification pre-requirements membrane theory of cylindrical shells, Bending theory of cylindrical shells, design of cylindrical shells beam theory of cylindrical shells, north light cylindrical shells.

UNIT – 4: **[13]**

Folded plate: introduction types and analysis with design. Introduction to shells of double curvature, membrane theory. Development in shell design.

REFERENCES:

1. Ramaswamy G S., "Design Construction, Concrete Shell Roofs", CbS Publishers, 2005.
2. Szilard R;, "Theory & Analysis of Plates" Prentice Hall, New York, 1974.
3. Timoshenko & Krieger W., "Theory of Plates and shells", Mc Graw Hill Kiga New York, International Edition, 1980.

4. Shames & Dym, “Energy & Finite Element Methods in Structural Mechanics”, New Age International Publications, New York, 1991. Billington, D. “Thin Shell Concrete Strucutres”, Mc-Graw Hill Book Co., New York, 2000.

Department of Civil Engineering, IITE,

Indus University

3rd Semester

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

M-TECH (STRUCTURAL ENGINEERING), SEMESTER–III TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017														
SR NO	CODE	SUBJECTS	TOTAL CREDITS	TEACHING SCHEME (HOURS)			EXAMINATION SCHEME						TOTAL
							INTERNAL			EXTERNAL			
				L	T	P	REPORT	VIVA-VOCE	PRESENTATION	REPORT	VIVA-VOCE	PRESENTATION	
1	ST0301	Dissertation Phase – I	20	-	-	40	50	50	50	50	50	50	300
TOTAL			20	-	-	40	50	50	50	50	50	50	300

Subject: **Dissertation Phase-I**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST0301**			Semester: **III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
0	0	40	20	-	75/150	-	75/150	300

Department of Civil Engineering, IITE,

Indus University

4th Semester

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

M-TECH (STRUCTURAL ENGINEERING), SEMESTER –IV TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017														
SR NO	CODE	SUBJECTS	TOTAL CREDITS	TEACHING SCHEME (HOURS)			EXAMINATION SCHEME						TOTAL
							INTERNAL			EXTERNAL			
				L	T	P	REPORT	VOVO	PRESENTATION	REPORT	VOVO	PRESENTATION	
1	ST0401	Dissertation Phase – II	20	-	-	40	50	50	50	50	50	50	300
TOTAL			20	-	-	40	50	50	50	50	50	50	300

Subject: **Dissertation Phase-II**								
Program: **M. Tech. In Civil Engg. (Structural Engineering)**				Subject Code: **ST0401**			Semester: **IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
0	0	40	20	-	75/150	-	75/150	300