Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Post Graduation (M. Tech.)

SoE & Syllabus 2014

3 Semester

Department of Civil Engineering

Structural Engineering

Update on May 2017

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M. Tech. SCHEME OF EXAMINATION 2014

Department of Civil Engineering

Structural Engineering

Sl. No.	Course Code	Course Title	Contact Hours				Credits	% Weightage				ESE Duration Hrs.
			L	T	P	Total Contact Hrs.		MSE- I	MSE- II	TA	ESE	
I SEMESTER												
1	CV1901	Numerical Methods	3	0	0	3	3	15	15	10	60	3
2	CV1902	Theory of Elasticity and Elastic Stability	3	0	0	3	3	15	15	10	60	3
3	CV1903	Structural Dynamics	3	0	0	3	3	15	15	10	60	3
4	CV1904	Lab: Structural Dynamics	0	0	2	2	1			40	60	
5	CV1905	Matrix Analysis of Structures	3	0	0	3	3	15	15	10	60	3
6	CV1906	Lab: Matrix Analysis of Structures	0	0	2	2	1			40	60	
7	CV1907	Design of Substructures	3	0	0	3	3	15	15	10	60	3
8	CV1908	Research Practice	0	0	2	2	1			100		
Total			**15**	**0**	**6**	**21**	**18**					
II SEMESTER												
1	CV1911	Finite Element Method	3	0	0	3	3	15	15	10	60	3
2	CV1912	Theory of Plates and Shells	3	0	0	3	3	15	15	10	60	3
3	CV1913	Earthquake and wind effects on Structures	3	0	0	3	3	15	15	10	60	3
4	**Professional Elective-I**		3	0	0	3	3	15	15	10	60	3
	CV1914	Advanced Concrete Structures										
	CV1915	Prestressed Concrete										
	CV1916	Composite Structures										
5	**Professional Elective-II**		3	0	0	3	3	15	15	10	60	3
	CV1917	Advanced Steel Structures										
	CV1918	New Engineering Materials										
	CV1919	Smart Structures and Applications										
6	CV1920	Lab: Steel Design Studio	0	0	2	2	1			40	60	
7	CV1921	Lab: RCC Design Studio	0	0	2	2	1			40	60	
8	CV1922	Seminar	0	0	2	2	1			100		
Total			**15**	**0**	**6**	**21**	**18**					
III SEMESTER												
1	**Professional Elective-III**		3	0	0	3	3	15	15	10	60	3
	CV1923	Tall Building										
	CV1924	Design of Environmental Strucutres										
	CV1925	Bridge Engineering										
2	**Professional Elective-IV**		3	0	0	3	3	15	15	10	60	3
	CV1926	Plastic Analysis and Design of Structures										
	CV1927	Seismic Analysis and Design of Structures										
	CV1928	Design of Industrial Structures										
3	CV1929	Project Phase-I	0	0	16	16	8			100		
Total			**6**	**0**	**16**	**22**	**14**					
IV SEMESTER												
1	CV1931	Project Phase- II	0	0	24	24	12			40	60	
Total			**0**	**0**	**24**	**24**	**12**					
Grand Total of Credits							**62**					

Chairperson		**Date of Release**	May 2014	**Applicable for**
Dean (Acad. Matt.)		**Version**	**1**	**AY 2014-15 Onwards**

III SEMESTER

CV1923	PE-III Tall Buildings		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION	
15	15	10	60	100	3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
• To understand horizontal load acting on a building i.e. earthquake and wind and design the building for above loading by providing shear walls / shear core. • To understand various aspects of high rise building such as the effect of torsion, soft storey effect, p-delta effect and drift index. • To understand detailing of RCC members for ductile behavior as IS Codes provisions.	• An ability to analyze the high-rise structures by considering various loads. • An ability to design RCC structures with ductile detailing. • An ability to use mathematical modeling techniques to design high rise structures. • An ability to understand IRC codes related to earthquake and wind load.
PO mapped: a, b, c, g	

UNIT – I
Earthquake & wind load Calculations along with dead load & live loads by Static analysis. Introduction to Frame – shear wall buildings, Mathematical modeling of buildings with different Structural systems. Analysis & Design of shear walled buildings.

UNIT – II
Special aspects in Multi- Story buildings like effect of torsion, flexible first storey, p- delta effect, Soil – Structure Interaction on building response, drift limitations. Ductility of reinforced members subjected to flexure. Design of braced columns using codal provisions.

UNIT – III
Beam – column jointed for ductile behaviors.
Multistory building with bracings &infills.

UNIT – IV
Introduction to Diaphragm. Seismic design of floor diaphragm.

TextBooks:
1. Agrawal P. & , Shrikhande M., Earthquake Resistant Design of Structures, Prentice hall India, New Delhi, 4th Edition, 2007.
2. Verghese P.C., Advance Reinforced Concrete Design, Prentice hall of India, New Delhi, 2001.

Reference Books:
1. Park, R. &Paulay, T., Reinforced Concrete Structures, John Willey & Sons; 2nd Edition, 1975
2. Paulay, T. &Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
3. FarzadNaeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
4. Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

III SEMESTER

CV1924	PE-III Design of Environmental Structures		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION	
15	15	10	60	100	3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
• To provide the students clear and thorough understanding of various environmental structures. • To provide the knowledge of analysis and design of water supply and treatment plants and reservoirs. • To provide the knowledge of analysis and design of jack well/Pump house / approach bridges. • To provide the knowledge of analysis and design of pretreatment units i.e. clariflocculator aerators, flash Mixture, sand filters etc.	• An ability to analyze and design water supply and treatment plants depending upon the capacity. • An ability to analyze and design reservoirs depending upon the capacity. • An ability to analyse and design jack well/Pump house / approach bridges. • An ability to analyse and design pretreatment units i. e. clariflocculator aerators, flash Mixture, sand filters etc.
PO mapped: a, b, e, f, g	

UNIT - I
Design of rectangular RCC reservoirs.

UNIT - II
Design of circular RCC reservoirs.

UNIT - III
Design of jack well/Pump house / approach bridges.

UNIT - IV
Design of pretreatment units: clariflocculator, aerators, flash Mixture, sand filters etc.

Text Books:
1. Ramamrutham S., "Design of Reinforced Concrete Structures", Dhanpat Rai& Sons publications, 12th edition, 1995
2. Jain A.K., "Reinforced Concrete limit stste design", Nem Chand & Bros. Roorkee., 4th edition, 1993

Reference Books:
1. Ghali, A., Circular Storage Tanks and Silos, E & F N Spon, London, (1979)
2. Jain, S.K. &Jaiswal, O.R., Guidelines for seismic design of liquid storage tanks, NICEE, IITK, 2004
3. Anchor, R.D., Design of liquid retaining concrete structure, Edward Arnold, London, (1992)

III SEMESTER

CV1925	PE-III Bridge Engineering			L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME							
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
• To provide the students clear and thorough understanding of various types of bridges and loadings. • To provide the knowledge of seismic behavior and design philosophy for bri • To provide the concept of earthquake behavior and design philosophy for retaining wall and Abutments. • To provide the student with a thorough understanding of IS codes related to bridges.	• Ability to identify the type of bridge to be used for various site and loading conditions. • An ability to analyze and design various types of bridges and the components. • An ability to draw RCC detailing and to prepare working drawing. • An ability to Understand IS codes related to bridges.
PO mapped: a, b, e, f, g	

UNIT – I
Types of bridge superstructure and introduction to their design, sub-structure, bearings, IRC / IRS Bridge loadings and other codal recommendations.

UNIT – II
Seismic design philosophy for Bridges, State of art modeling of bridges, Seismic Design of Substructures, Capacity design of substructures and ductile detailing, Seismic design of well and pile foundations.

UNIT – III
Earthquake behavior and Design of retaining wall and Abutments, IS code recommendations.

UNIT – IV
Design of Bearings (Free, Guided and Restrained). Introduction to long span bridges: cable stayed bridges and suspension bridges.

Text Books:
1. N. Krishna Raju, Design of bridges, Oxford & IBH publishing Co. Ltd., New Delhi.
2. D. Johnson Victor, Essentials of bridge engineering, Oxford & IBH publishing Co. Ltd., New Delhi.
3. Jagdeesh R. and Jairam M., " Design of bridges", PHI Publication New Delhi, 2nd edition,

Reference Books:
1. IRC: 5 -1970, Standard specifications and code of practice for road bridges, Sections I to V, Indian Roads Congress, New Delhi.
2. Chen, W.F. and Duan, L., Bridge Engineering Handbook, CRC Press, 1999
3. Indian railway standard code of practice for the design of steel or wrought iron bridge carrying rail, road or pedestrian traffic, Govt. of India, Ministry of Railways, 1962.
4. Hambly, E.C., Bridge deck behaviour, Chapman and Hall, London
5. O'Brien E.J. and Keogh D.L., Bridge deck analysis, E& FN Spon, New York

III SEMESTER

CV1926	PE-IV Plastic Analysis & Design of Steel Structure	L=3	T=0	P=0	CREDITS = 3

EVALUATION SCHEME					
MSE – I	**MSE – II**	**TA**	**ESE**	**TOTAL**	**ESE DURATION**
15	15	10	60	100	3 hours

COURSE OBJECTIVES	COURSE OUTCOMES
• To provide the students clear and thorough understanding of modeling of discrete single-degree and multiple-degree vibratory systems and calculate the free and forced response of these systems. • To provide the students clear and thorough understanding of Calculation of the mode shapes and frequencies for the free response of continuous vibratory systems and use modal methods to calculate the forced response of these systems. • To provide the students understanding of modeling continuous vibratory systems – vibration of strings, axial and torsional vibration of bars and beams. • To provide the student with a basic understanding of IS codes related to earthquake loading.	• An ability to understand behavior of steel structure elements beyond yield point loading and basic concepts of plastic analysis. • An ability to understand techniques for estimation of collapse loads on steel structures • An ability to understand the effects of axial and shear forces on plastic moment of resistance • An ability to understand philosophies of plastic design of steel structural elements
PO mapped: b, c, e	

UNIT I:
Plastic behavior, review curves of structural steel, plastic moments, shape factors, load factors, plastic hinge, types of collapse, collapse mechanism, collapse load factor.

UNIT II:
Upper and lower bound, uniqueness theorems, principle of virtual work, statical method, minimum and maximum theorems, step by step method.

UNIT III:
Methods of release of restrains, load interaction diagrams, method of inequalities.

UNIT IV:
Plastic Moment distribution applied to continuous beams & portal frames (Max. two bays single storey)

UNIT V:
Effect of Axial force & Shear force on Plastic moment of resistance

UNIT VI:
Design of beams, continuous beams and portal frames up to two storey – two bays. Minimum weight analysis, introduction to stability.

Reference Books:
1. "Limit state Design of Steel Structures", S K Duggal , McGraw Hill education, 2010
2. "Limit State Design of Steel Structures", Dr. M R Shiyekar, PHI Publication, 3rd Print
3. A.S. Arya and J.L. Ajmani – Design of Steel Structures, Nemchand& Bros., Roorkee
4. Ramchandra – Design of Steel Structures Vol – II, Standard Book House, Delhi
5. B.G. Neal – Plastic Method of Structural Analysis, Chapman & Hall
6. L.S. Beedle – Plastic Design of Steel Frames, John Willey & Sons
7. Structural design in steel by SalwarAlamRaz New Age International Publishers 15/44
8. Steel Designers Manual – ELBS

General Reading Suggested:
1. Codes: IS: 800 - 2007 Code of Practice for General Construction in SteelHand books
2. SP: 6 (6) – 1972 Handbook for Structural Engineers: Application of plastic Theory in Design of Steel Structures
3. Handbook for Structural Engineers SP 6 (8) 1972 (Reaffirmed 1993) – Bureau of Indian Standards.
4. NPTEL

Chairperson		Date of Release	May 2017	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Version	1.01	

III SEMESTER

CV1927	PE-IV Seismic Analysis and Design of Structures		L=3	T=0	P=0	CREDITS = 3
EVALUATION SCHEME						
MSE – I	MSE – II	TA	ESE	TOTAL	ESE DURATION	
15	15	10	60	100	3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
• To provide the students clear and thorough understanding of the basic concepts of Earthquake resistant design • To provide the students clear and thorough understanding of analysis and design aspects of RCC and Steel members subjected to earthquake loads. • To provide the students clear and thorough understanding of detailing of RCC and steel members for ductile behavior. • To provide the students clear and thorough understanding of various Indian codes related to earthquake engineering.	• An ability to apply basic concepts Earthquake resistant design in construction industry. • Ability to identify, formulate and solve engineering problems pertaining to earthquake effects on structures. • An ability to Understand IS codes related to static as well as dynamic analysis of high rise buildings. • An ability to design special structures subjected to more effective earthquake forces.
PO mapped: a, b, c	

RCC Structures

UNIT - I

Performance of RC buildings, behavior of RC buildings in past earthquakes, influence of asymmetry, infill walls, foundations, soft story, confinement of concrete, and ductility.

UNIT - II

Capacity Design of RC Members, Design for Strong column & weak beam, Design of Beam-Column Joints.

UNIT - III

Shear wall with ductile detailing. Preliminary sizing and Modeling of RC Buildings, Ductility and factors affecting ductility of RC members.

Steel Structures

UNIT - IV

Performance of steel structures in past earthquakes, basics of Steel Design, introduction to plastic analysis and design, design philosophy for steel structures.

UNIT - V

Capacity design concept, Ductility of steel buildings, Seismic behavior of steel structures, Stability considerations.

UNIT - VI

Seismic Design and detailing of Moment Resistant Frames, Beams and Columns.

Text Books:

1. Agrawal P. & , Shrikhande M., Earthquake Resistant Design of Structures, Prentice hall India, New Delhi, 4th Edition, 2007.
2. Agrawal P. &, Shrikhande M., Earthquake Resistant Design of Structures, PHI Publisher, New Delhi.
3. Bruneau, M.; Uang, C.M.; & Whittaker, A Ductile Design of Steel Structures McGraw Hill.
4. Mazzolani, F.M.; &Piluso Theory and Design of Seismic Resistant Steel Frames E&FN Spon

Reference Books:

1. Paulay, T. &Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
2. FarzadNaeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
3. Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

III SEMESTER

CV1928	PE-IV Design of Industrial Structures		L=3	T=0		P=0	CREDITS = 3
	EVALUATION SCHEME						
MSE – I	MSE – II	TA	ESE	TOTAL		ESE DURATION	
15	15	10	60	100		3 hours	

COURSE OBJECTIVES	COURSE OUTCOMES
• To understand the various classification and components of industrial structure • To understand the various loads calculation of large span structures • To understand the concept of silos and bunker structures • To understand the foundation steps of industrial structures	• An ability to understand planning of industrial structures. • An ability to analyse large span structures. • An ability to understand stability of silos and bunkers under dynamic loads. • An ability to analyse and design foundations for industrial structures.
PO mapped: a, b, c, g	

UNIT-I:
PLANNING OF INDUSTRIAL STRUCTURES:
Classification of industries and local regulations - Factors affecting planning - General Aspects – Civil Engineering Aspects - Light and Ventilation.

UNIT-II:
LARGE SPAN STRUCTURES IN INDUSTRIES
Cable roofs - Types of cable roofs - Analysis of a cable subjected to concentrated loads and uniformly distributed load, Complexities in the analysis of a cable roof, Overview of deep beams, Virrendel Girder,Castellated Girders - Introduction to earthquake forces.

UNIT-III
SILOS AND BUNKERS
Concept of Angle of Repose - Pressure distribution - Dynamic loads - Stability of bunkers – Foundations.

UNIT-IV:
FOUNDATIONS FOR INDUSTRIAL STRUCTURES
Machine foundations - General requirements - Design criteria - General analysis - Design of a block foundation for vertical compressor - Vibration Isolation - Foundations for Chimney and Microwave Towers.

Text books:
1. Srinivasula P. Hand Book of Machine FoundationTata McGraw Hill Publications, New Delhi. First Edition, 2000
2. RamchandraDesign of Steel StructuresStandard Book House, New DelhiSeventh Edition, 2000
3. Raghupati M. Design of Steel StructuresTata McGraw Hill Publication, DelhiFirst Edition, 2003
4. Dayaratnam P. Design of Steel StructuresWheelr's Publishers, Allahabad1995
5. AnandArya&Ajmani J. L. Design of Steel StructuresNemchand& Bros., Roorkee, U.P., IndiaForth Edition, 2004
6. Lambert F.W. The Theory & Practical Design of BunkersThe British Constructional Steelwork Association Ltd., London, UK2000

III SEMESTER

CV1929	Project Phase I		L=0	T=0	P=12	CREDITS = 6
EVALUATION SCHEME						
MSE – I	MSE – II	CA	ESE	TOTAL		ESE DURATION
		100		100		

COURSE OBJECTIVES	COURSE OUTCOMES
• To provide the students the academic environment to carry out literature survey of advanced topics in structural engineering • To motivate the students to use the modern tools and software's • To provide the students the understanding of various aspects like effective communication skills, working independently and in a team and the importance of lifelong learning etc. to carry out project.	• An ability to solve real world structural engineering problems. • An ability to understand the importance of lifelong learning and the use of modern tools. • An ability to understand the importance of lifelong learning and the use of modern tools • An ability to work independently and in a team for effective communication
PO mapped: a, c, d, e, f, g	

The Project Phase – I shall start in semester III, and should preferably be literature survey of a live problem or a macro issue in the industry.

The work shall be continuously evaluated as per the norms/ guidelines set up by the B.O.S. for its assessment of 100 marks.

Evaluation of Project Phase – I shall consist of submission of report in a prescribed format based on a comprehensive and critical review of literature related to the topic selected for dissertation. Report should cover introduction, literature review, objective and scope of investigation and pilot studies carried out during the semester. The student will deliver the seminar thereon which will be assessed by panel of examiners.