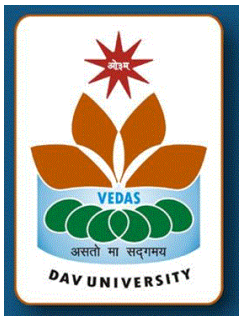
DAVUNIVERSITY JALANDHAR



Scheme & Syllabus

Master of Technology

IN

Structural Engineering

Batch 2023 onwards

1st to 4th SEMESTER

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1: Graduates of the program will have in-depth knowledge to identify and formulate challenging problems in Structural Engineering, apply appropriate research methodologies, use modern engineering tools and provide technically sound, economical and sustainable solutions.

PEO2: Graduates will have ability for higher studies and undertake high value research on Structural Engineering and other related issues.

PEO3: Graduate of program will actively engage in a professional career as a Structural Consultant and has sound analytical and lateral thinking ability to engage in lifelong learning for professional advancement to cope up with multidisciplinary and changing technologies in Structural Engineering

PEO4: Graduates of the program will have sense of social responsibility, will demonstrate ability to communicate and work effectively as a team member in an ethical way, and will play leadership roles in their profession, public services and community

PROGRAMME OUTCOMES

PO1: Apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.

PO2: Write and present a substantial technical report/ document.

PO3: Demonstrate a degree of mastery in Structural Engineering. (The mastery at a level higher than the requirements in the appropriate bachelor program.)

PO4: Gain knowledge/ skill in integrating Structural Engineering concepts for collaborative multidisciplinary solutions, carry out planning and management of projects considering economic and financial factors as a member and as a leader of the team.

PO5: Recognize the need for and have ability in lifelong learning independently for professional advancement, demonstrate professional ethics, work culture and understanding of responsibility to contribute to community for sustainable development of society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Analyze and design reinforced concrete structures and steel structures as per the standard design of codes.

PSO2: Address the societal needs by interdisciplinary approach through advanced courses and get exposed to the latest technologies to be industry ready or to pursue advanced research.

PSO3: Independently carry out research / investigation to solve practical problems and write / present a substantial technical report / document.

Scheme of Courses

Master of Technology in Structural Engineering

Semester-1

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	MGT551	Research Methodology	4	0	0	4	Core
2	CES553	Advanced Structural Analysis	4	0	0	4	Core
3	CES 501	Dynamics of Structure	4	0	0	4	Core
4	CES 503	Analysis and Design of Foundations	4	0	0	4	Core
5	CES 505	Bridge Engineering	4	0	0	4	Core
6	CES 507	Structural Engineering Laboratory-I	0	0	4	2	Core (Lab)
			20	**0**	**4**	**22**	

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses

Master of Technology in Structural Engineering

Semester-2

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	CES 502	Theory and Design of plates and Grids	4	0	0	4	Core
2	CES 5XX	Department Specific Elective-I	4	0	0	4	DSE-1
3	CES 5XX	Department Specific Elective-II	4	0	0	4	DSE-2
4	CES 5XX	Department Specific Elective-III	4	0	0	4	DSE-3
5	XXX	Generic Elective - I	4	0	0	4	GE-1
6	CES 510	Structural Engineering Laboratory-II	0	0	4	2	Core (Lab)
7	CES 512	Seminar	0	0	4	2	Seminar
			20	**0**	**8**	**24**	

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses

Master of Technology in Structural Engineering

Semester-3

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	CES 5XX	Department Elective-IV	4	0	0	4	DSE-4
2	XXX	Generic Elective -II	4	0	0	4	GE-2
3	CES 513	Dissertation Part-I	0	0	12	8	Dissertation Part - 1
4			**8**	**0**	**12**	**16**	

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses

Master of Technology in Structural Engineering

Semester-4

S.NO.	Paper Code	Course Title	L	T	P	Cr	Nature of Course
1	CES514	Dissertation Part - II	0	0	0	12	Dissertation Part - 2
			0	0	0	**12**	

L: Lectures T: Tutorial P: Practical Cr: Credits

Department Specific Electives

DSE-1	Course Code	Course Title	L	T	P	Cr.	Area of Specialization
	CES521	Pre-stressed Concrete	4	0	0	4	Structures
	CES 523	Finite element analysis	4	0	0	4	Structures
	CES 525	Tall Structures	4	0	0	4	Structures
	CES 527	Ground Improvement	4	0	0	4	Structures
	CES 529	Soil Structure interaction	4	0	0	4	Structures

DSE-2	Course Code	Course Title	L	T	P	Cr.	Area of Specialization
	CES 522	Advanced Structural Design and Detailing	4	0	0	4	Structures
	CES 524	Advanced Solid Mechanics	4	0	0	4	Structures
	CES 526	Disaster Reduction and Management	4	0	0	4	Structures
	CES 528	Design of Steel and Steel-Concrete composites	4	0	0	4	Structures
	CES 530	Site investigations	4	0	0	4	Structures

DSE-3	Course Code	Course Title	L	T	P	Cr.	Area of Specialization
	CES531	Design of Industrial Structures	4	0	0	4	Structures
	CES 533	Earthquake resistant design of Masonry and RC Buildings	4	0	0	4	Structures
	CES 535	Hydraulic Structures	4	0	0	4	Structures
	CES 537	Advanced Concrete Technology	4	0	0	4	Structures
	CES 539	Building Services	4	0	0	4	Structures

DSE-4	Course Code	Course Title	L	T	P	Cr.	Area of Specialization

	CES 532	Construction Techniques And Management	4	0	0	4	Structures
	CES 534	Reliability Analysis Of Structure	4	0	0	4	Structures
	CES 542	Wind Effect on Structures	4	0	0	4	Structures
	CES 544	Infrastructure Planning And Management	4	0	0	4	Structures
	CES 546	Rehabilitation Of Structures	4	0	0	4	Structures

L: Lectures T: Tutorial P: Practical Cr: Credits

Generic Electives

S. No	Course Code	Course Title	L	T	P	Cr.
1	ELE901	Renewable Energy Sources	4	0	0	4
2	ELE902	Energy Audit and Management	4	0	0	4
3	CHL901	Analytical Techniques	4	0	0	4
4	CHL902	Pollution Abatrment and Control Equipment's	4	0	0	4
5	MEC901	Methods Engineering and Ergonomics	4	0	0	4
6	MEC902	Power Plant Engineering	4	0	0	4
7	CSE901	Soft Computing	4	0	0	4
8	CSE902	Mobile Communications	4	0	0	4
9	ECE901	Smart Sensors	4	0	0	4
10	ECE902	Silicon Chip Technology	4	0	0	4
11	CIV901	Transportation Engineering	4	0	0	4
12	CIV902	Water Resource Engineering	4	0	0	4
13	MGT051	Business Strategy	4	0	0	4
14	MGT052	Principles of Marketing	4	0	0	4
15	MTH551	Numerical Analysis	4	0	0	4
16	MEC707	Industrial safety	4	0	0	4
17	CIV903	Cost management and Engineering Projects	4	0	0	4

M Tech Course Structure							
CBCS	**Nature of Courses**	**Core**	**Elective Courses**			**Ability Enhancement Courses**	
Year	**Course Structure**	**Core**	**Dissertation/ Project**	**Generic Elective**	**Discipline Specific Elective**	**Ability Enhancement Compulsory Courses**	**Skill Enhancement Courses**
(2023)	**Structural Engineering**	28	22	8	16	0	0

Detailed Syllabus

In hours			
L	T	P	Credit
4	0	0	4

SEMESTER 1

Course Code	**MGT551**						
Course Title	**Research Methodology**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Understand research problem formulation. CO2: Student will able to analyze research related information CO3: Student will able to follow research ethics						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							
•	Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations						CO1
	Effective literature studies approaches, analysis Plagiarism , Research ethics						
	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee						
Unit 2							
•	Patent Rights - Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.						CO1, CO2
Unit 3							
•	New Developments in IPR - Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.						CO2, CO3
Unit 4							
•	Nature of Intellectual Property - Patents, Designs, Trademark and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.						CO3
Text Book/s	• Stuart Melville and Wayne Goddard, Research methodology: an introduction for science & engineering students • Wayne Goddard and Stuart Melville, "Research Methodology: An						

	Introduction” • Ranjit Kumar, 2nd Edition , “Research Methodology: A Step by Step Guide for beginners” • Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007. • Mayall, “Industrial Design”, McGraw Hill, 1992. • Niebel , “Product Design”, McGraw Hill, 1974. • Asimov , “Introduction to Design”, Prentice Hall, 1962. • Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016. • T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES553**						
Course Title	**Advanced Structural Analysis**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Solve the skeletal structures using the direct stiffness method CO2: Student will able to solve the skeletal structures using flexibility method CO3: Student will able to develop the computer programs using the direct stiffness method and Use the commercial software for the analysis						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	**Influence Coefficients:** Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach. **Stiffness Method applied to Large Frames:** Local Coordinates and Global Coordinates.						
Unit 2							CO1, CO2
•	**Stiffness Matrix Assembly of Structures:** Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.						
Unit 3							CO3
•	**Applications to Simple Problems:** Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach. **Boundary Value Problems** (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.						
Unit 4							CO3
•	**Linear Element:** Shape Functions, Solution for Poisson's Equation, General One Dimensional Equilibrium Problem.						
Text Book/s	• Matrix Analysis of Framed Structures, Weaver and Gere. • The Finite Element Method, Lewis P. E. and WardJ. P., Addison-Wesley Publication Co.						

	• Computer Methods in Structural Analysis, MeekJ. L., E and FN, Span Publication. • The Finite Element Method, Desai and Able, CBS Publication.	

In hours			
L	T	P	Credit
4	0	0	4

Course Code	**CES501**						
Course Title	**Dynamics of Structure**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to apply fundamental theory of structural dynamics and equation of motion CO2: Student will able to analyze and study dynamics response of single and multi-degree-of freedom systems. CO3: Student will able to use the available software for dynamic analysis.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Single Degree of Freedom Systems, Free and Forced vibration, Dynamic response, Transient and Steady state forcing functions.						
Unit 2							CO2
•	Damping effects, Greens Function, Multi-degree of Freedom Systems Natural frequencies and mode shapes, Vanello Stodola and Matrix iteration methods						
Unit 3							CO3
•	Energy methods, Lagrange's equation, Simple applications Continuous Systems, Approximate solutions, Rayleigh, Ritz Methods, Vibrations of building frames, Modal Analysis.						
Unit 4							CO3
•	Base excited system, formulation of equations for SDOF & MDOF systems, concepts of spectral quantities and response spectrum, fundamental of earthquake engineering, Solution of eigen value problems mode superposition method and modal truncation errors-modal acceleration method, direct integration method, explicit and implicit methods						
Text Book/s	• A.K. Chopra. Dynamics of Structures, 3rd Edition, Pearson, 2007. • Clough and Penzien. Dynamics of Structures, 5th Edition, McGraw Hill, 1975. • John M. Biggs. Introduction to Structural Dynamics, 1st Edition, McGraw Hill Book Co, 1964. 4. Mario Paz. Structural Dynamics Theory and Computation, 2nd Edition, CBS Publishers,2010.						

	• Clough and Penzien. Dynamics of Structures. New Delhi: McGraw-Hill Education (ISE Editions); International 2 Revised edition (1 August 199 • Grover,G.K. Mechanical Vibrations. Roorkee: Nem Chand & Bros., 1972. • Walter C. Hurty & Moshe F. Rubinsten. Dynamics of Structures. USA: Prentice Hall, 1964	

In hours			
L	T	P	Credit
4	0	0	4

Course Code	**CES503**						
Course Title	**Analysis and Design of Foundation**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: To determine the bearing capacity of soil and the probable settlement and also to select the type of depth of foundation for a project. CO2: To import empirical knowledge of soil behavior required by the geotechnical engineer for the design of foundation and other soil related structures. CO3: Student will know about design pile foundations for structures						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Functions and requisites of a foundation - Different types - Choice of foundation type – Types of deep foundation – Types of pile foundations- Factor governing choice of type of pile – Choice of pile materials, - Load carrying capacity of piles by static formulae: Introduction- Pile driving formulae selection of pile hammers- Determination of temporary elastic compression- Driving stresses in piles- Field measurement- Wave equation analysis						
Unit 2							CO2
•	Group action in piled foundations: Introduction- Minimum spacing of piles- group efficiency- Estimation of group bearing capacity- Effect on pile groups of installation methods- Settlement of pile group- Reduce differential settlement in pile group						
Unit 3							CO1CO2
•	Bearing capacity of shallow foundations based on the classical earth pressure theory of Rankine. Prandtl's theory, Terzaghi's theory, Meyerhof's theory						
Unit 4							CO3
	Retaining Walls-Types - Stability analysis of cantilever retaining walls against overturning and sliding-Bearing capacity considerations- Structural design of retaining walls Introduction to well foundations – Elements of well foundations – Types – Sinking stresses in wells – Design of well cap, Well staining, well curb, cutting edge and bottom plug						

Text Book/s	• J.E. Bowles. Foundation Analysis and Design. New Delhi: McGraw Hill, 1996. • M.J. Tomlinson. Foundation Design and Construction. USA: Addison Wesley, 2001. • M.J. Tomlinson. Pile Design and Construction Practice. UK: E & FN Spon, 1987. • Braja M. Das. Principles of Foundation Engineering. Singapore : Thomson Asia Pte , 1987, London Ltd., 2005, A viewpoint publication. • P.C. Varghese. Foundation Engineering. New Delhi: Prentice-Hall of India, 2005.	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES505**						
Course Title	**Bridge Engineering**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to understand behaviour of Bridge components CO2: Student will able to understand the components of bridges CO3: Student will know the design of simple bridges						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Introduction-definition and components of bridges. Layout and planning of bridges- classification, investigations for bridges, preliminary data collection, choice of type of the bridges, hydraulic design of bridges, traffic design of bridges.						
Unit 2							CO1CO2
•	Analysis and design of superstructure of straight and curved bridge decks- Loadings details, specification-reinforced concrete and steel decks. Decks of various types like slab, hollow and voided slab, beam and slam, box girder etc						
Unit 3							CO3
•	Design of substructure-piers and abutments of different types. Analysis and design of foundations- shallow foundations (open Foundations), deep foundations- well foundations and caisson.						
Unit 4							CO3
	Modern methods of construction of concrete and steel bridges- their impact on the analysis and the design. Introduction to analysis and design of long span bridges like suspension and cable stayed bridges. Special aspects in analysis and design, based on construction methodology. Inspection and maintenance and rehabilitation of bridges.						
Text Book/s	• Johnson Victor D. Essentials of Bridge Engineering. New Delhi: Oxford & IBH Pub.Co., 2007. • Vazirani V. N., Design of Concrete Bridges, Khanna publishers,2004. • Jagadeesh T.R and Jayaram M.A. Design of Bridge Structures. New Delhi: Prentice Hall, 2004.						

	• Krishnaraju, N. Design of Bridges. New Delhi: Oxford & IBH Pub. Co., 2010. • Krishnaraju, N. Prestressed Concrete bridges, New Delhi: CBS Publishers, 2010. • IRC 6-2000,IRC 21-2000,IS 800-2007,IRC 18-1985,IRC 24-2001,IRC 83-1987.	

In hours			
L	**T**	**P**	**Credit**
0	0	4	2

Course Code	**CES507**						
Course Title	**Structural Engineering Laboratory-I**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Handle appropriate equipments and tools CO2: Student will able to Design simple experiments related with structural systems CO3: Student will Function as team member for laboratory work						
Examination Mode	Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	0%	0%	0%	0%	0%	80%	20%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
	Study of the effect of water/cement ratio on workability and strength of concrete - Effect of aggregate/cement ratio on strength of concrete - Effect of fine aggregate/coarse aggregate ratio on strength and permeability of concrete - Study of Mix design methods - study of stress-strain curve of concrete - correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture - effect of cyclic loading on steel - Non-Destructive testing of concrete - Study of behavior of Beams under flexure, Shear and Torsion.						CO1CO2CO3
Text Book/s	• Nevilli, A. M.. Properties of Concrete. 5th Edition, USA: Prentice Hall, 2012 • Shetty, M. S. Concrete Technology. Delhi: S. Chand & Co. 2006.						

SEMESTER 2

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES502**						
Course Title	**Theory and Design of Plates and Shells**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to understand basic concepts of theory of plates and shells CO2: Student will able to solve problems related to thin plates and shells CO3: Student will apply the numerical techniques and tools for the complex problems						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	**Pure Bending of Plates:** Slopes and curvatures, Relations between bending moment and curvature, Strain energy. **Symmetrical Bending of Circular Plates:** Differential equation in Polar co-ordinates, Uniformly loaded circular plate with or without hole at the centre and with various edge conditions.						
Unit 2							CO1
•	**Rectangular Plates:** Differential equation of the deflection surface (Small deflection theory only), Fourier Series expansion for various types of loads, Rectangular plates with various loading and edge conditions, Navier's & Levy's methods. **Introduction to Shell Structures:** Development of shell structures, Advantages and disadvantages of shell structures, Forms of shells, Mathematical equations of various curves connected with shells, I.S. code provisions on folded plates and shell structures						
Unit 3							CO2
•	**Analysis of Shell Structures:** Structural behaviour of cylindrical shells, Shell dimensions and allowances, Methods of analysis, Approximate analysis covering beam action, Arch action, Membrane action, Design of cylindrical shells by approximate method, Skylight in a shell, Reinforcement details. **Membrane Analysis of Shells:** General theory, Derivation of expressions for membrane forces for various directrices, for self-weight and snow load, Perturbational stresses for shells with edge beams and shells without edge beams, Effect of concentrated live load, Design by						

	membrane theory.	
Unit 4		CO1CO3
	Folded Plate Structures: General, Various shapes, Advantages and Disadvantages, Structural action of a folded plate structure, Methods of analysis, Design by any one method. **Introduction to Grid Structures:** Various methods for analyzing grids for roofs and bridges.	
Text Book/s	• Timoshenko S.P. and Krieger S. W. Theory of Plates and Shells. New Delhi: Tata Mc Graw Hill, 1959 • Chandrashekhara K., Theory of Shells, Universities (India)Press Ltd., 2001 • Ramaswamy G. S., Design and Construction of Concrete Shell Roofs, CBS Publishers, 2005. • Bairagi N. K., Plate Analysis. Delhi: Khanna Publishers, 1986 • Kelkar V. S. and Sewell R.T., Fundamentals of the Analysis and Design of Shell Strutures. New Delhi: Prentice Hall Inc., 1987 • T.K.Varadan & K. Bhaskar, Análysis of plates – Theory and problems. Bangalore: Narosha Publishing Co., 1999. • Reddy J N. Theory and Analysis of Plates and Shells. Taylor and Francis, 2006	

Departmental Specific Elective-I

In hours			
L	T	P	Credit
4	0	0	4

Course Code	**CES521**						
Course Title	**Pre-stressed Concrete**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to understand the basic aspects of pre-stressed concrete fundamentals, including pre and post-tensioning processes CO2: Student will able to find out losses in the pre-stressed concrete CO3: Student will know about the **a**nalyze and design fully pre-stressed concrete flexural members, compression members. CO4: Student will able to design end blocks with pre-stressing anchorages						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Reinforced and prestressed concrete construction - Prefabricated structures - Production of ready mixed concrete - Productivity analysis						
Unit 2							CO2
•	Pre-stressing systems and end anchorages, losses of pre-stress. Composite construction: Types, analysis and design. Concept of partial prestressing. Circular prestressing: Analysis and design of pipes and water tanks,						
Unit 3							CO3
•	Analysis and design of members for flexure, shear, bond and bearings. Cable layouts. Design of circular systems, domes and slabs.						
Unit 4							CO4
	Design of Pre-stressed Bridges, (Super-structure only). Design of Continuous beams.						
Text Book/s	• Krishna Raju N. Prestressed concrete. New Delhi: Tata McGraw Hill Company, 1998. • Mallick S.K., Gupta A.P., Prestressed concrete, Delhi: Oxford and IBH publishing Co. Pvt. Ltd. 1997. • Rajagopalan, N. Prestressed Concrete. Delhi: Alpha Science, 2002. • Ramaswamy G.S. Modern prestressed concrete design. New Delhi: Arnold Heinimen, 1990. • Lin T.Y. Design of prestressed concrete structures. Bombay: Asia						

	Publishing House, 1995. • IS 1343: 1980 Indian Standard Code of Practice for Prestressed Concrete • IS 456: 2000 Indian Standard Code of Practice for Plain and Reinforced Concrete	

In hours			
L	T	P	Credit
4	0	0	4

Course Code	**CES523**						
Course Title	**Finite Element Analysis**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Implement advanced concepts in Finite Element Analysis CO2: Student will able to Solve plate and shell problems CO3: Student will Solve non-linear structural engineering problems						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Basic equations of solid mechanics-review of equilibrium conditions, strain – displacement relations, stress – strain relations, principles of virtual work and stationary potential energy and various formulations. Approximate methods Rayleigh, Ritz weighted residual (Galerkin) and finite difference methods.						
Unit 2							CO1
•	Finite element method: displacement model-shape functions Lagrange and Serendipity elements. Element properties-isoperimetric elements-numerical integration technique assemblage of elements and solution technique for static analysis. Analysis of framed structures-2D & 3D truss and beam element and applications.						
Unit 3							CO2
•	Analysis of plan stress/strain and ax symmetric solids-triangular, quadrilateral and isoperimetric elements, incompatible modes. Three dimensional stress analysis, isoperimetric 8 and 20 nodded elements.						
Unit 4							CO3
	Analysis of plate bending-basic equations of thin plate theory Reissinner-Mindlin theory- plate elements and applications. Analysis of shells-degenerated shell elements. Finite element programming and FEA software.						
Text Book/s	• Cook R D et al. Concepts and Applications of Finite Element Analysis. Singapore: John Wiley & Sons. . • Krishnamoorthy C S. Finite Element Analysis- Theory and						

	Programming. New Delhi: Tata McGraw Hill. • Bathe K J. Finite Element Procedures in Engineering Analysis. New Delhi: Prentice Hall. • Zienkiewicz, O.C. and Taylor, R.W. Finite Element Method. UK: Elsevier Butterworth-Heinemann. • Rajasekharan S. Finite Element Analysis in Engineering Design, New Delhi: Wheeler. • Chandrupatla T R and Belegundu A D. Introduction to Finite Elements in Engineering, New Delhi: Pearson Education. • Hutton D V. Fundamentals of Finite Element Analysis, New Delhi: Tata McGraw Hill Education Private Ltd.	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES525**						
Course Title	**Tall Structures**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to identify about different systems and various loads in Tall structures CO2: Student will able to identify about various structural systems and their behavior CO3: Student will know about interpret static, dynamic and stability analysis of various systems CO4: Student will able to classify various Flooring systems and modern progress of tall structures						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Definition of tall building-need for constructing tall building-Historic background-factors affecting growth. Design Criteria, Design Philosophy of High Rise structures, Materials, Loading gravity loading- Dead and live load, live load reduction techniques-sequential loading, Impact loading, Wind Loading, Wind Characteristics, Static and Dynamic wind Effects.						
Unit 2							CO2
•	Analytical and wind tunnel experimental method, Earthquake loading-equivalent lateral force method, modal analysis, Introduction to Performance based seismic design. Structural form, Floor systems, Rigid frame Structures- rigid frame behaviour –approximate determination of member forces by gravity loading- two cycle moment distribution, approximate determination of member forces by lateral loading- Portal method, Cantilever method, approximate analysis of drift.						
Unit 3							CO3
•	Structural design of tall concrete and masonry buildings: commentary structure a standards, plastic analysis-strength of members and correction, non-linear analysis and limit design, stability, stiffness and crack control creep shrinkage and temperature effects. Limit state design, masonry structures.						
Unit 4							CO4

	Frame-shear wall systems: Twist of frame. Analysis of shear wall, frame wall interaction, analysis of coupled shear wall, computation of earthquake load dynamic analysis of tall building.	
Text Book/s	• Smith Bryan Stafford, Coull Alex. Tall Building structures: Analysis and Design, New York Wiley-Interscience, , 1991. • Taranath Bungale S. Structural Analysis and Design of Tall Buildings. New Delhi: Tata Mc Graw Hill,1988. • Kolousek V, Pimer M, Fischer O and Naprstek J, Wind effects on Civil Engineering Structures. Elsevier Publications.1984. • Robert L Wiegel. Earthquake Engineering. USA: Prentice Hall, 1970. • ATC40- Seismic evaluation and retrofitting of concrete buildings, Seismic safety commission, California 1996. • Wolfgang Schuller. High Rise Building structures. UK: JohnWiley and sons, 1977. • Mark Fintel. Hand book of concrete engineering. Van Nostrand Reinhold, 1985. • FEMA 445, Next generation Performance based seismic design guidelines, FEMA, 2006.	

In hours			
L	T	P	Credit
4	0	0	4

Course Code	**CES527**						
Course Title	**Ground Improvement**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to demonstrate how theoretical knowledge and observation of engineering performance assist in rational application of ground modification procedure. CO2: Student will able to give a thorough understanding of the various techniques used in ground improvement. CO3: Student will know about the different materials in improving bearing capacity of soil..						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Role of ground improvement – Drainage and groundwater lowering – Well point systems –Thermal and freezing methods – Insitu densification – Deep compaction– Dynamic compaction – Blasting – Sand piles – Preloading with sand drains – Stone columns-Lime piles.						
Unit 2							CO2
•	Earth reinforcement – Rock bolts – Cables and guniting – Geotextiles as reinforcement – Filtration. Drainage and Erosion control – Soil Nailing – Micro piles.						
Unit 3							CO3
•	Grouting – Types – Rheology – Applications – Electro chemical stabilization – Physical and chemical aspects of stabilization – stabilization with cement, lime etc.						
Unit 4							CO4
	Soil Stabilization: Lime stabilization-Base exchange mechanism, Pozzolanic reaction, lime-soil interaction, lime columns, Design of Foundation on lime columns. Cement stabilization. Mechanism, amount, age and curing. Fly-ash – Lime Stabilization, Soil Bitumen Stabilization.						
Text Book/s	• Manfred Hausmann, Ground modification (1990) – McGraw Hill, New York. • Purushothama Raj, Ground Improvement Techniques Laxmi Publications, New Delhi, India, 1999. • F.G. Bell, Foundation Engineering in Difficult Ground (1978),						

	Butterworth – Heinmann, 1978. • Frank Harris, Ground Engineering Equipments and Methods, McGraw hill Book Company Ltd, New York, 1983.	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES529**						
Course Title	**Soil Structure Interaction**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to elucidate soil structure interaction concept and complexities involved. CO2: evaluate soil structure interaction for different types of structures under various conditions of loading and subsoil characteristics. CO3: evaluate interaction analysis of pile and pile groups with rigid cap. CO4: evaluate action of group of piles under lateral loading considering stress-strain characteristics of real soils.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1	**Soil foundation Interaction**						CO1
•	Introduction to soil foundation interaction problems, soil behaviour, foundation behaviour, interface behaviour, scope of soil foundation interaction analysis, soil response models,						
Unit 2	**Beam on Elastic foundation-soil models**						CO2
•	Infinite beam, two parameters, Isotropic elastic half space, analysis of beams of finite length, classification of finite beams in relation to their stiffness.						
Unit 3	**Plate on Elastic medium**						CO3CO4
•	Infinite plate, Winkler, two parameters, isotropic elastic medium, thin and thick plates, analysis of finite plates: rectangular and circular plates, Numerical analysis of finite plates, simple solutions.						
Unit 4	**Elastic analysis of piles**						CO4
	Elastic analysis of single pile, theoretical solutions for settlement and load distributions, analysis of pile group, interaction analysis, load distribution in groups with rigid cap.						
Text Book/s	• Elastic analysis of soil foundation interaction by Selva durai, A.P.S. • Pile Foundation Analysis and Design by Poulos, H.G. & Davis E.H. • Foundation Analysis by Scott, R.F. • Structure Soil Interaction- State of Art Report, Institution of Structural Engineers, 1978 • Geotechnical Earthquake Engineering By Kramer, S.L						

In hours			
L	T	P	Credit
4	0	0	4

Departmental Specific Elective-II

Course Code	**CES522**						
Course Title	**Advanced Structural Design and Detailing**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: design and carry out the reinforcement detailing for different components of Building CO2: design and detail RC retaining walls. CO3: Should be able to analyse the behaviour and drift capacities of various high rise structural forms.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Introduction to limit state method of design, provisions in the Indian standard codes for loading wind loads and seismic loads, design and detailing of concrete structures. Design and Ductile Detailing of R.C.C. Structures as per I.S. 13920-1993 Repair and Seismic Strengthening of Buildings as per I.S. 13935-1993. Design and Detailing Requirements as per 4326-1993.						
Unit 2							CO2CO1
•	**Building Frames:** Introduction, Loads, Analysis for vertical loads, Analysis for lateral loads, Concept of redistribution of moments, Reinforcement detailing in various components.						
Unit 3							CO3
•	**Flats Slabs:** Advantages and disadvantages of flat Slabs, Action of Flat Slab, Preliminary design of flat slabs, Basic action of two-way slab, Determination of minimum thickness of slab, Direct Design Method, Equivalent frame analysis of flat slabs.						
Unit 4							CO3
	Special Structural Elements: Domes, Deep Beams, Brackets or Corbels, Grid floor systems, Retaining walls						
Text Book/s	• Dayaratnam, P. Reinforced Concrete Structure 2007 • Jain, A.K. Reinforced Concrete, Limit State Method of Design, 2007 • Punmia, B.C. Reinforced Concrete Structures, Vol II 2007						

	• Jain and jaikrishna Plain and Reinforced Concrete Vol II 2003 • P.Dayaratnam :Design of Steel Structures: 2005 • Varghese, P. C., Limit State Design of Reinforced Concrete, PHI Publishers (2002). • B.I.S. Codes IS 4326, 13828, 13920, 13935	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES524**						
Course Title	**Advanced Solid Mechanics**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Understand basic concepts of Elasticity and Plasticity CO2: Student will able to Solve problems of elasticity and plasticity applied to isotropic materials CO3: Student will able to Introduce Fracture Mechanics and its applications						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Theory of stress, state of stress in a body, Differential equations of equilibrium. Analysis of state of stress at a given point in a body						
Unit 2							CO2
•	Geometrical theory of strains, displacement components and strain components and relation between them, generalized hooks law						
Unit 3							CO1CO3
•	Strains expressed in terms of stresses, stresses expressed in terms of strains, torsion of prismatic bars and bending						
Unit 4							CO3
	Saint- Venant method, three dimensional stress systems, tensors, unsymmetrical bending.						
Text Book/s	• S.Timoshenko. Theory of elasticity. New Delhi: McGraw-Hill Publishing Company; 3rd edition (October 1, 1970), 2003. • 2. M.Filonenko. Theory of elasticity. New Delhi: John Wiley & Sons, 2001.						

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES526**						
Course Title	**Disaster Reduction and Management**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to impart awareness about the effect of earthquakes on structures. CO2: Student will able to study IS code provisions for the analysis, design and detailing of earthquake resistant Structures CO3: Student will be capable of design and detailing of earthquake resistant structures						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Elements of earthquake engineering- characteristics of ground motion – earthquake intensity and magnitude- recording instruments -seismic zoning- earthquake effects on different types of structures- Effect of architectural features and structural irregularities- review of damages during past earthquakes						
Unit 2							CO2
•	IS Code provision for design and detailing for earthquake resistance- reinforcement detailing for members and joints- design examples. Repair and rehabilitation of damaged structures- case studies- methods for disaster mitigation- Vulnerability assessment and seismic evaluation of structures– vulnerability reduction						
Unit 3							CO3
•	Management cell, Central crisis management core group, damage reconnaissance, Management of relief and rehabilitation (Infrastructure rehabilitation, Housing rehabilitation, Social rehabilitation), Role of volunteers, Emergency operation centers, Information system, Danger zone restrictions, Cooperation with local authority, Coordination for international relief, Role of government, NGO's, Business and donors, Role of remote sensing in relief operations, Information management and related technologies in engineering and disaster management.						
Unit 4							CO2

	Principles and guidelines for earthquake resistant design of structures- Design lateral forces- Static analysis – Dynamic analysis- Shear walls	
Text Book/s	• IS: 1893-2002, Indian Standard criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi • IS: 4326-1993, Indian Standard code for practice for Earthquake Resistant Design and Construction of Buildings, Bureau of Indian Standards, New Delhi. • IS: 13920-1993, Indian Standard Ductile Detailing of RCC Structures subjected to seismic forces-Code of practice, Bureau of Indian Standards, New Delhi • SP: 22-1982, Explanatory Handbook on codes of Earthquake Engineering, Bureau of Indian Standards, New Delhi • Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures. New Delhi: Prentice- Hall of India. • Anil K Chopra, Dynamics of Structures. Prentice- New Delhi: Hall of India. • S. K. Duggal-Earthquake Resistant Design of Structures-Oxford University Press-2007	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES528**						
Course Title	**Design of steel and steel concrete composites**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will identify the behavior of composite beams and columns CO2: Student will able to design and analysis the steel structures like gantry girders framed connections, compression and tension members. CO3: Student will be able to design connections in composite structures						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Design of members subjected to lateral loads and axial loads - Principles of analysis and design of Industrial buildings and bents - Crane gantry girders and crane columns – Analysis and design of steel towers - Design of industrial stacks – Self-supporting and guyed stacks lined and unlined.						
Unit 2							CO1CO2
•	Types of connections, Design of framed beam connections, Seated beam connection, Unstiffened, Stiffened Seat connections, Continuous beam – to - beam connections and continuous beam–to–column connection both welded and bolted. Cold formed Steel Sections - Types of cross sections - Local buckling and post buckling - Design of compression and Tension members - Beams - Deflection of beams – Combined stresses and connections.						
Unit 3							CO2CO3
•	Introduction to composite design – shear connectors – types of shear connectors – degrees of shear connections – partial and full shear connections – composite sections under positive bending – negative bending – propped conditions – un-propped conditions – deflection of composite beams.						
Unit 4							CO3
	Introduction – Composite slabs – profiled sheeting – sheeting parallel to span – sheeting perpendicular to span - Types of Composite columns – design of encased columns – design of in-filled columns – axial, uni-axial and bi-axially loaded columns. Composite shear wall – double skinned						

	composite deck panels – composite trusses – composite frames – composite plate girders.	
Text Book/s	• Arya, A.S. Design of Steel Structures. New Delhi: New Chand & brothers, 1982. • R.P. Johnson. Composite Structures of Steel & Concrete. UK: Blackwell Scientific publications, 1994.	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES530**						
Course Title	**Site Investigation**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to gain a practical understanding of the planning and design of site investigations CO2: Student will able to gain the spectrum of available investigation techniques. CO3: Student will be able to the laboratory test scheduling, and interpretation of results						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Soil formation Processes – Characteristics of major soil deposits of India. Necessity and Importance of soil exploration Method of sub surface exploration Test pits , Trenches, Caissons, Tunnels and drifts, Wash boring , Percussion drilling , Rotary drilling, Factors affecting the selection of a suitable method of boring. Extent of boring, Factors controlling spacing and depth of bore holes, Spacing and depth for various Civil engineering structures.						
Unit 2							CO1CO2
•	Indirect method of exploration, Seismic method, Electrical resistivity, Resistivity sounding and profiling, Qualitative and quantitative interpretation of test results, Comparison of resistivity and seismic surveys, Shortcomings. Ground water Observation: Different method of ground water observation: Time lag in observation, Sampling of ground water.						
Unit 3							CO2CO3
•	Sampling: Source of disturbance and their influence, Type of sampler, Principle of design of sampler, Representative and undisturbed sampling in various types of soils, Surface sampling, Amount of sampling, Boring and sampling record, Preservation and shipment of sample preparation of bore log. Standard penetration test, Dynamic cone penetration tests with and without bentonite mud slurry. Static cone penetration test, Surface sampling. Cyclic plate load test, Large shear box test, Vane shear						

	test, Pile load, In situ Permeability. Pumping in test and pumping out test	
Unit 4		CO3
	Investigation below sea/river bed – methods and equipment's – interpretation of offshore exploration, Instrumentation in soil engineering - strain gauges - resistance and inductance type - load cells, earth pressure cells - settlement and heave gauges - piezometers and slope indicators - inclinometer, Field visit, data and report preparation.	
Text Book/s	• Hvorsler M. "Subsurface exploration and sampling of soil for Civil Engg. Purposes • Simon and Cayton " Site investigation"	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES530**						
Course Title	**Site Investigation**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to gain a practical understanding of the planning and design of site investigations CO2: Student will able to gain the spectrum of available investigation techniques. CO3: Student will be able to the laboratory test scheduling, and interpretation of results						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Soil formation Processes – Characteristics of major soil deposits of India. Necessity and Importance of soil exploration Method of sub surface exploration Test pits , Trenches, Caissons, Tunnels and drifts, Wash boring , Percussion drilling , Rotary drilling, Factors affecting the selection of a suitable method of boring. Extent of boring, Factors controlling spacing and depth of bore holes, Spacing and depth for various Civil engineering structures.						
Unit 2							CO1CO2
•	Indirect method of exploration, Seismic method, Electrical resistivity, Resistivity sounding and profiling, Qualitative and quantitative interpretation of test results, Comparison of resistivity and seismic surveys, Shortcomings. Ground water Observation: Different method of ground water observation: Time lag in observation, Sampling of ground water.						
Unit 3							CO2CO3
•	Sampling: Source of disturbance and their influence, Type of sampler, Principle of design of sampler, Representative and undisturbed sampling in various types of soils, Surface sampling, Amount of sampling, Boring and sampling record, Preservation and shipment of sample preparation of bore log. Standard penetration test, Dynamic cone penetration tests with and without bentonite mud slurry. Static cone penetration test, Surface sampling. Cyclic plate load test, Large shear box test, Vane shear						

	test, Pile load, In situ Permeability. Pumping in test and pumping out test	
Unit 4		CO3
	Investigation below sea/river bed – methods and equipment's – interpretation of offshore exploration, Instrumentation in soil engineering - strain gauges - resistance and inductance type - load cells, earth pressure cells - settlement and heave gauges - piezometers and slope indicators - inclinometer, Field visit, data and report preparation.	
Text Book/s	• Hvorsler M. "Subsurface exploration and sampling of soil for Civil Engg. Purposes • Simon and Cayton " Site investigation"	

Departmental Specific Elective-III

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES531**						
Course Title	**Design of Industrial Structures**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to analyze and design of basic reinforced concrete and Steel components. CO2: Student will able to identify design principles and IS code specifications. CO3: Student will be able to design industrial buildings.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Analysis and Design of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular c truss, Truss for a railway platform.						
Unit 2							CO1CO3
•	Planning of Industrial Structures, Steel Gantry Girders - Portal Frames - Gable Structures - Lightweight Structures						
Unit 3							CO2CO3
•	Design and detailing of Steel Bunkers- Silos, RC Bunkers and Silos- Water Tanks						
Unit 4							CO2
	Design of Steel Chimneys, Towers, Hyperbolic Cooling Towers.						
Text Book/s	• N. Krishna Raju. Advanced Reinforced Concrete Design. New Delhi: CBS Publishers & Distributors. • Chandra, Ram. Design of Steel Structures. Jodhpur: Scientific Publishers, 2007. • Duggal. Design of Steel Structures. New Delhi: McGraw-Hill Education (India) Pvt Limited, 2009. • P. Dayaratnam. Design of Steel Structures. Delhi: S. Chand & Company Ltd., 2010 • Vazirani and Ratwani. Design of steel structures. New Delhi: Khanna Publishers						

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES533**						
Course Title	**Earthquake Resistant Design of Masonry and RC Buildings**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Plan a good structural configuration for seismic resistance. CO2: Student will able to Calculate the earthquake design forces using appropriate methods as per IS 1893-2002(Part-I). CO3: Student will able to Design the structure using IS 13920 code provisions. CO4: Student will be capable of applying the concept of Ductility and Base isolation in designing earthquake resistant structures.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Introduction to Seismicity, Earthquake Motion and Response, Response Spectra, Philosophy of Capacity Design.						
Unit 2							CO2CO3
•	Concepts of seismic design: Earthquake resistant design of R.C.C Structures and IS:1893. Earthquake resistant construction of R.C.C. Elements: Detailing aspects and IS:13920.						
Unit 3							CO1
•	Earthquake resistant design of Brick Masonry Structures and IS: 4326						
Unit 4							CO4
	Introduction to Indian Standards, related to Earthquake Engineering. Earthquake resistant design of Bridges.						
Text Book/s	• Fundamentals of earthquake engineering Newmark N.M. and Rosenblueth E. • Earthquake Design practice for Buildings Key, D • Dynamics of Structures Anil K. Chopra • Dynamics of Structures Clough and Penzien • Seismic design of R.C.C & Masonry Structures Pauley, T. and Priestley • Bridge Engineering: Seismic Design W.F. Chen & Lian Duan.						

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES535**						
Course Title	**Hydraulic Structures**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will learn about the components and effect of different hydraulics structures. CO2: Student will able to Understand and design the different elements of dam. CO3: Student will be able to design To study IS code provisions for the analysis, design and detailing of hydraulics structures						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Design procedure for irrigation channels, Irrigation outlets, Canal masonry						
Unit 2							CO2
•	Principles of design, use of flow net, Khosla's theory , Regulation works - Falls, distributary head regulators, Cross regulators.						
Unit 3							CO2CO3
•	Cross drainage works, Canal head Works, Earth Dams, Gravity Dams, Spillways and Energy dissipaters						
Unit 4							CO3
	Escapes, Trench weirs, Supply channel and head regulator.						
Text Book/s	• R.S. Varshney, S.C. Gupta and R.L. Gupta; Theory and Design of Irrigation Structures, Nemchand & Brothers, Roorkee, 1992. • R.k. Sharma; Irrigation Engineering and Hydraulic Structures, Oxford and IBH Publishing Co., New Delhi, 1984. • Arora, K.R. "Irrigation water power and Water Resources engineering", Standard Publishers Distributors, Delhi, 2002.						

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**Advanced Concrete Technology**						
Course Title	**CES537**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Discuss the concrete ingredients and its influence at gaining strength. CO2: Student will able to Summarize the concepts of conventional concrete and its differences with other concretes like no fines, light weight etc. CO3: Student will be able to Describe the application and use of special concretes like fiber reinforced concrete, self-compacting and high performance concrete.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Aggregates classification- Testing Aggregates, fibres. Cement, grade of Cement, chemical composition, Hydration of Cement, Structure of hydrated Cement, Special Cement, Water, Chemical and Mineral Admixtures.						
Unit 2							CO2
•	Principles of Concrete mix design, methods of Concrete mix design, Design of high strength and high performance concrete.						
Unit 3							CO2
•	Rheological behaviour of fresh Concrete- Properties of fresh and hardened concrete- Strength, Elastic properties, Creep and Shrinkage, Variability of concrete strength. Nondestructive testing and quality control, Durability, corrosion protection and fire resistance.						
Unit 4							CO3
	Modern trends in concrete manufacture and placement techniques, Methods of transportation, Placing and curing-extreme whether concreting, Special concreting methods, Vacuum dewatering of concrete-Under water concreting. Light weight Concrete, Fly-ash Concrete- Fibre reinforced Concrete, Polymer Concrete, Epoxy resins and screeds for rehabilitation-properties and application.						
Text Book/s	• Krishnaraju, N. Advanced Concrete Technology. New Delhi: CBS Publishers, 1985.						

	• Nevile, A.M. Concrete Technology. New York: Prentice Hall, , 1985. • Santhakumar, A.R. Concrete Technology. New Delhi: Oxford University Press2006.	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES539**						
Course Title	**Building Services**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to gain various methods of record keeping, preparation of checklists. CO2: Student will able for the identification of defects and selecting suitable repair techniques. CO3: Student will be able for the suitable repair and rehabilitation techniques						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Orientation and Planning - Grouping and circulation - lighting and ventilation - Termite proofing of buildings- Lightning protection of buildings						
Unit 2							CO2
•	Fire protection of buildings - Vertical transportation – Prefabrication systems in residential buildings: Planning and modules and sizes of components in prefabrication						
Unit 3							CO2CO3
•	Shell structures - Domes - Folded plate structures - Skeletal and space frame structures - Grain storage structures - Earthquake resistant structures - Air-conditioning and heating - Acoustics and Sound insulation – Plumbing services.						
Unit 4							CO3
	Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking Maintenance, repair and rehabilitation, Facets of and importance of Maintenance Preventive measures on various aspects Inspection						
Text Book/s	• Arora, Bindra, Building Construction. New Delhi: Dhanpat Rai, 2012. • Hand Book of Housing Statistics, NBO, 2003. • National Building Code of India, Bureau of Indian Standards, 2005. • Raikar, R.N., Learning from failures – Deficiencies in Design,						

	Construction and Service – R&D Centre (SDCPL). Bombay: Raikar Bhavan, 1987. • Allen R.T., Edwards S.C. Repairs of Concrete Structures.UK: Blaike an Sons, 1987.	

In hours			
L	**T**	**P**	**Credit**
0	0	4	2

Course Code	**CES510**						
Course Title	**Structural Engineering Laboratory-II**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Deploy low end applications using low and high level languages on microcontroller platform CO2: Student will able to Implement simple sketches on the Arduino boards involving several peripherals CO3: Student will Identify, design and implement applications on the Arduino boards producing custom shields						
Examination Mode	Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	0%	0%	0%	0%	0%	80%	20%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
	Program for design of slabs using Excel. Program for design of beams using Excel. Program for design of column using Excel. Program for design of footing using Excel. Analysis of Continuous beams using STAAD Pro. Analysis of Portal frames using STAAD Pro. Analysis and Design of truss using STAAD pro. Analysis and Design of multi storeyed space frame using STAAD pro.						CO1CO2CO3

In hours			
L	**T**	**P**	**Credit**
0	0	4	2

Course Code	**CES512**						
Course Title	**Seminar**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Final his/her dissertation topic CO2: Student will able to gain skill of presentation						
Examination Mode	Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	0%	0%	0%	0%	0%	80%	20%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
	The student has to present a seminar in one of the current topics in the stream of specialization. The student will undertake a detailed study based on current published papers, journals, books on the Chosen subject, present the seminar and submit seminar report at the end of the semester**.**						CO1CO2

In hours			
L	T	P	Credit
4	0	0	4

SEMESTER 3

Departmental Specific Elective- IV

Course Code	**CES532**						
Course Title	**Construction Techniques and Management**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to identify the structural systems for various combinations of gravity and horizontal loading considering their functional use and heights. CO2: Student will able to analyze the behavior and drift capacities of various high rise structural forms CO3: Student will Understand the drift capabilities of different structural forms						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Reinforced and prestressed concrete construction, Prefabricated structures, Production of ready mixed concrete, Productivity analysis, Economics of form work, Design of Formwork and their reusability,						
Unit 2							CO2
•	Modular construction Practices, Fibonacci series, its handling and other reliable proportioning concepts. Modular coordination, Standardization, system building, Lamination and Advantages of modular construction						
Unit 3							CO2CO3
•	Construction Law - public law; Government Departments and Local Authorities; Private Law, Contracts, Torts, property law and building law. Construction Contracts - Contract Specifications - types of contract documents used for construction						
Unit 4							CO3
	Contract Procurement - selecting a contractor. Contract procedure Disputes, Arbitration and litigation procedure- preparation, settlement, evidence. Price Adjustment: need for the formulae, comparison with previous system, Civil Engineering and building formulae, practical implications.						
Text Book/s	• Allen E, Iano, J, Fundamentals of Building Construction Material and Method, John Wiley & Sons, 2011. • Cameron K. Andres, Ronald C. Smith, Principles and Practices of						

	Commercial Construction, 8th Edition, Prentice Hall, 2009. • Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M. Tripathi Private Ltd.,Bombay, 1982. • Jimmie Hinze, Construction Contracts, 2nd Ed., McGraw Hill, 2001. • Joseph T. Bockrath, ontracts and the Legal Environment for Engineers and Architects, 6th Edition,McGraw Hill, 2000.	

In hours			
L	**T**	**P**	**Credit**
4	0	0	4

Course Code	**CES534**						
Course Title	**Reliability Analysis of Structure**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to identify the structural systems for various combinations of gravity and horizontal loading considering their functional use and heights. To analyze the behavior and drift capacities of various high-rise structural forms. CO2: Student will able to learn basic concepts related to reliability analysis of structures. CO3: Student will know the use of general concepts of statistics for probabilistic analysis.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Concepts of Structural Safety: General, Design methods. Basic Statistics: Introduction, Data reduction, Histograms, Sample correlation. Probability Theory: Introduction, Random events, Random variables, Functions of random variables, Moments and expectation, Common probability distribution, External distribution.						
Unit 2							CO2CO1
•	Resistance Distributions and Parameters: Introduction, Statistics of properties of concrete, Statistics of properties of steel, Statistics of strength of bricks and mortar, Dimensional variations, Characterization of variables, Allowable stresses based on specified reliability. Probabilistic Analysis of Loads: Gravity loads, Wind load.						
Unit 3							CO3
•	Basic Structural Reliability: Introduction, Computation of structural reliability. Monte Carlo Study of Structural Safety: General, Monte Carlo method, Applications. Level 2 Reliability Methods: Introduction, Basic variables and failure surface, First-order second moment methods (FOSM).						
Unit 4							CO3
	Reliability Based Design: Introduction, Determination of partial safety factors, Safety checking formats, Development of reliability based design criteria, Optimal safety factors, Summary of results of study for Indian						

	standard – RCC design. Reliability of Structural Systems: Preliminary concepts as applied to simple structures.	
Text Book/s	• Ranganatham, R. "Structural Reliability Analysis and Design" • Melchers, R.E. "Structural Reliability" • Ditlevsen, O. and Madsen, H.O. , Structural Reliability methods, John Wiley & Sons (2007). • Madsen, H.O., Krenk, S. and Lind, N.C, Methods of structural safety, John Wiley & Sons (1999).	

In hours			
L	T	P	Credit
4	0	0	4

Course Code	**CES542**						
Course Title	**Wind effect on Structures**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to study the effect of wind loads, pressure variance on low and high rising structure CO2: Student will able to study the design consideration for different civil engineering structure in relationship with aerodynamic modifications CO3: Student will Design of structures for wind resistance.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Introduction: Nature of wind storm, Design wind speed, Atmospheric boundary coyer and Wind turbulence. Basic Bluff body aerodynamics: Flow around bluff bodies, Pressure & force coefficients flow around flat plates, Walls, Prismatic shapes.						
Unit 2							CO1
•	Wind effects on Low Buildings: Low buildings with different roof shapes and multi-span buildings. Wind effects on Tall Buildings: Along wind effects, across wind effects and vortex shedding.						
Unit 3							CO2
•	Wind effects on Bridges: Basic force coefficients for bridges, Nature of dynamic response of long span bridges, Flutter instability, Buffeting of long span bridges.						
Unit 4							CO3
	Role of Wind Tunnel: Flow simulation, Modelling, Flow measurement, Pressure measurement, Deformation measurement.						
Text Book/s	• Simiu, E., Scanlan, Robert H., Effects on Structures, Dover Publications, (1996). • Sachs, P., Wind Forces in Engineering, Pergamon Press (1972). • Holmes, J.D., Wind Loading of Structures, Taylor & Francis (2007).						

In hours			
L	T	P	Credit
4	0	0	4

Course Code	**CES544**						
Course Title	**Infrastructure Planning and Management**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will develop basic skills to serve various planning, development and management agencies in different professional capacities in the public sector as well as in private consultancy organizations later in their careers. CO2: Student will equipped with knowledge of basic theories, techniques, and design concepts to assume their assigned professional roles as members of multi-disciplinary teams which involve survey, analysis and plan making for an urban/regional areas						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	An overview of Basic Concepts Related to Infrastructure: Introduction to Infrastructure., An Overview of the Power Sector in India., An Overview of the Water Supply and Sanitation Sector in India., An overview of the Road, Rail, Air and Port Transportation Sectors in India. , An overview of the Telecommunications Sector in India. , An overview of the Urban Infrastructure in India. , An overview of the Rural Infrastructure in India. An Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle., an Overview of Infrastructure Project Finance						
Unit 2							CO2
•	Private Involvement in Infrastructure: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply: A Case Study, Challenges in Privatization of Power: Case Study. Privatization of Infrastructure in India : Case Study, Privatization of Road Transportation Infrastructure in India.						
Unit 3							CO3
•	Challenges to Successful Infrastructure Planning and Implementation: Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks: The Case study, Political Risks : The case study,: Socio-Environmental Risks : Case study, Cultural Risks in						

	International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.	
Unit 4		CO4
	Strategies for Successful Infrastructure Project Implementation: Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects, Sustainable Development of Infrastructure, Information Technology and Systems for Successful Infrastructure Management, Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.	
Text Book/s	• Grigg, Neil, Infrastructure engineering and management, Wiley, (1988). • Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994). • Hudson, Haas, and Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997). • Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June (1990). • World Development Report 1994: Infrastructure for Development (1994). • Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States," 1st European Pavement Management Systems Conference, Budapest, September (2000).	

In hours			
L	T	P	Credit
4	0	0	4

Course Code	**CES546**						
Course Title	**Rehabilitation of Structures**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to identify the causes for deterioration of structures and remedies through damage assessment. CO2: Student will able to learn various methods of diagnosis for the damage by Semi destructive and non-destructive tests CO3: Student will know about identify various retrofitting techniques and repair procedures						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
Unit 1							CO1
•	Maintenance and repair strategies: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of distress and deterioration of concrete- Evaluation of existing buildings through field investigations, Seismic evaluation of existing buildings. Serviceability and durability of concrete: Quality assurance for concrete construction concrete properties – strength, permeability, thermal properties and cracking. – Effects due to climate, temperature, chemicals, corrosion – design and construction errors – Effects of cover thickness and cracking.						
Unit 2							CO2
•	Materials and techniques for repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning - Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection.						
Unit 3							CO3

•	Repairs, rehabilitation and retrofitting of structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure - Special techniques for structural Retrofitting (Bracing, Shear walls, Base isolation etc)	
Unit 4		CO4
	Demolition techniques: Engineered demolition techniques for Dilapidated structures – case studies - Case Studies on Restoration of fire damaged buildings, Case study on repairs and strengthening corrosion damaged buildings; Case study on use of composite fibre wraps for strengthening of building components.	
Text Book/s	• Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, (1991). • R.T. Allen and S.C. Edwards, Repair of Concrete structures, Blakie and Sons, UK, (1987) • M. S. Shetty, Concrete Technology – Theory and Practice, S. Chand and Company, New Delhi, (1992). • Santhakumar, A.R., Training Course notes on Damage Assessment and repairs in Low Cost Housing, "RHDC – NBO" Anna University, July (1992). • Raikar, R.., Learning from failures – Deficiencies in Design, Construction and Service – R & D centre (SDCPL), Raikar Bhavan, Bombay, (1987). • N. Palaniappan, Estate Management, Anna Institute of Management, Chennai, (1992).	

In hours			
L	**T**	**P**	**Credit**
0	0	12	16

Course Code	**CES13**						
Course Title	**Dissertation Part - I**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Identify structural engineering problems reviewing available literature. CO2: Identify appropriate techniques to analyze complex structural systems. CO3: Demonstrate application of engineering and management principles through efficient handling of project						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	0%	20%	0%	-	0%	80%	0%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
							CO1CO2CO3
•	The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports.						

In hours			
L	**T**	**P**	**Credit**
0	0	0	12

SEMESTER 4

Course Code	**CES114**						
Course Title	**Dissertation Part - II**						
Course Outcomes	**On the completion of the course the student will be able to** CO1: Student will able to Apply appropriate techniques and tools to solve complex structural problems. CO2: Exhibit good communication skill to the engineering community and society. Students will be able to demonstrate professional ethics and work culture. CO3: Contribute in efficient technology transfer to the society.						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	0%	20%	0%	-	0%	80%	0%
Syllabus	Theory/ Practical/ Theory + Practical						**CO Mapping**
							CO1CO2CO3
•	The student will submit a detailed Project Report on the topic approved by Departmental committee in a specified format and will also deliver a Presentation on the topic chosen at the end of semester.						