ADVANCED DESIGN OF STEEL STRUCTURES

As per NEP, Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

SEMESTER – II

Course Code	23SEC21	**CIE**	50
Number ofLecture Hours/Week	03+01	**SEE**	50
Total Number ofLecture Hours	52	**Exam Hours**	03

CREDITS – 04

Course objectives:

The objective of this course is to make students to learn design principles of structure, design different types of structures and detailing of the structures. To evaluate performance of thestructures.

Course Outcomes(COs):

*On completion of this course,*the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	AchieveKnowledgeofdesign procedure, Structural analysis anddevelopmentofproblem-solvingskills.		
CO2	Understand the principles, Structural analysis &Design		
CO3	Design and develop analyticalskills.		
CO4	Summarize the principles of Structural Designand detailing.		
CO5	Understanding the fire resisting concept.		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√	√	√		
CO2	√	√	√	√	√	
CO3	√	√		√		
CO4		√	√	√		
CO5		√	√	√		

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	2	3						1			1	3		
CO2	3	2	3						1			1	3		
CO3	3	3	3						1			1	3		
CO4	3		3						1			1	3		
CO5	3		2						1			1	3		

Modules	Teaching Hours	RBT Level
Module -1		
Laterally Unrestrained Beams: Lateral Buckling of Beams, Factors affecting lateral stability, IS 800 code provisions, Design Approach. Lateral buckling strength of Cantilever beams, continuous beams, beams with continuous and discretelateralrestraints,Mono-symmetricandnon-uniform beams – Design Examples. Concepts of -Shear Center, Warping, Uniform and Non-Uniform torsion.	**10Hours**	**L1,L2, L3,L4**
Module -2		
Beam- Columns in Frames: Behaviour of Short and Long Beam - Columns, Effects of Slenderness Ratio and Axial Force on Modes of Failure, Biaxial bending, Strength of Beam Columns, Sway and Non-Sway Frames, Strength and Stability of rigid jointed frames, Effective Length of Columns-, Methods in IS 800 – Numerical Examples	**10 Hours**	**L1,L2, L3,L4,L5**
Module -3		
Steel Beams with Web Openings: Shape of the web openings, practical guidelines, and Force distribution and failure patterns, Analysis of beams with perforated thin and thick webs, Design of laterally restrained castellated beams for given sectional properties, Vierendeel girders (design for given analysis results)	**10 Hours**	**L1,L2,L4**
Module -4		
Cold formed steel sections: Techniques and properties, Advantages, Typical profiles, Stiffened and unstiffened elements, Local buckling effects, effective section properties, IS 801& 811 code provisions- numerical examples, beam design, column design.	**10 Hours**	**L2,L3,L4**
Module -5		
Fire resistance: Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members, Methods of fire protection, Fire resistance. ratings- Numerical Examples.	**12 Hours**	**L2,L3,L4**

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 20marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under amodule.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. N. Subramanian, “Design of Steel Structures”, Oxford,IBH
2. Duggal S.K, “Design of Steel Structures” TataMcGraw-Hill 3. IS 1031, 1032,1033
3. IS 800: 2007,
4. IS 811.IS 801
5. INSDAG Teaching Resource Chapter 11 to 20:www.steel-insdag.org

EARTHQUAKERESISTANTSTRUCTURES
As per NEP, Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
SEMESTER–II

CourseCode	23SEC22	IAMarks	50
Numberof LectureHours/Week	03+01	ExamMarks	50
TotalNumberof LectureHours	52	ExamHours	03

CREDITS–04

Courseobjectives:

The objective of this course is to make students tolearnprinciplesofengineering seismology, todesign the reinforced concrete buildingsforearthquake resistance. To evaluate the seismic responseofthestructures.

Courseoutcomes:

Oncompletionofthiscourse,studentsareableto

CO#	Course Outcomes	POs	PSOs
CO1	AchieveKnowledgeofdesignanddevelopmentofproblem-solvingskills.		
CO2	Understandtheprinciplesofengineeringseismology.		
CO3	Designanddevelop analyticalskills.		
CO4	SummarizetheSeismicevaluationandretrofittingofstructures.		
CO5	Understandtheconceptsofearthquakeresistanceofreinforcedconcretebuildings.		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√	√	√	
CO3		√		√	√	
CO4		√		√	√	
CO5		√	√	√		

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO 1	PSO 2	PSO 3
CO1	3	2	3						1			1	3		
CO2	3	2	3						1			1	3		
CO3	3	3	3						1			1	3		
CO4	3		3						1			1	3		
CO5	3		2						1			1	3		

Modules	Teaching Hours	RBTLevel

Module-1		
Engineering Seismology: Causes of Earthquakes; Nature andOccurrence of Earthquakes; Seismic Waves; Measurements ofEarthquakes; Local Site Effects; Classification of Earthquakes;Earthquakegroundmotioncharacteristics:Amplitude,frequency,andduration;SeismiczoningmapofIndia	**10Hours**	**L_1,L_2**
Module-2		
ResponseSpectrum:Basicsofstructuraldynamics;Freeandforced vibration of SDOF system; Effect of frequency of inputmotion and Resonance; Numerical evaluation of response ofSDOFsystem(Linearaccelerationmethod),EarthquakeResponse spectrum:Definition,construction,Characteristics,andapplication; Elasticdesignspectrum.	**10Hours**	**L_2,L_3,L_4, L_5**
Module-3		
SeismicPerformanceofBuildingsandOverview ofIS-1893(Part-1):Typesofdamagestobuildingobservedduringpastearthquakes;Planirregularities;massirregularity;stiffnessirregularity;Conceptofsoftandweakstorey;Torsionalirregularityanditsconsequences;configurationproblems;continuousloadpath;Architecturalaspectsofearthquakeresistantbuildings;Lateralloadresistant systems. Seismicdesignphilosophy;Structuralmodeling;	**10Hours**	**L_2,L_4,L_5**
Module-4		
Determination of Design Lateral Forces: Equivalent lateral forceprocedureanddynamicanalysisprocedure.Stepbystepproceduresforseismicanalysis of RC buildings usingEquivalentstaticlateralforcemethodandresponsespectrummethods(maximumof4storeysandwithoutinfillwalls)	**11Hours**	**L_2,L_4,L_5**
Module-5		
Earthquake Resistant Analysis and Design of RC Buildings: Typicalfailures of RC frame structures, Ductility in Reinforced Concrete,Design of Ductile Reinforced Concrete Beams, Seismic Design ofDuctile Reinforced Concrete column, Concept of weak beam-strongcolumn,DetailingofBeam-ColumnJointstoenhanceductility,detailingasperIS-13920.RetrofittingofRCbuildings	**11Hours**	**L_2,L_5,L_8**

Questionpaperpattern:

- Thequestionpaperwill havetenquestions.
- Eachfullquestionconsistsof20marks.
- Therewill be2fullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestionscoveringallthetopicsunderamodule.
- Thestudents will havetoanswer5 full questions,selectingonefullquestionfrom eachmodule.

REFERENCEBOOKS:

1. Dynamics of Structures – Theory and Application to Earthquake Engineering-2nd ed. – Anil K.Chopra,PearsonEducation.
2. EarthquakeResistantDesignofBuildingStructures,VinodHosur,WILEY(india)
3. EarthquakeResistantDesignofStructures,Duggal,OxfordUniversityPress
4. Earthquakeresistantdesignofstructures-PankajAgarwal,ManishShrikande -PHIIndia
5. IS–1893(PartI): 2016,IS–13920:2016,

REPAIR AND REHABILITATION OF STRUCTURES
As per NEP, Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
SEMESTER – II

Course Code	23SEC232	IA Marks	50
Number of Lecture Hours/Week	03	Exam Marks	50
Total Number of Lecture Hours	42	Exam Hours	03
CREDITS – 03			

Course objectives:

The objective of this course is to make students to investigate the cause of deterioration of concrete structures, to strategize different repair and rehabilitation of structures. To evaluate the performance of the materials for repair.

Course Outcomes (COs):

On completion of this course,the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	Achieve Knowledge of design a development of problem-solving skills.		
CO2	Understand the cause of deterioration of concretestructures.		
CO3	Design and develop analyticalskills.		
CO4	Summarizetheprinciplesofrepairandrehabilitationofstructures		
CO5	Understands the concept of Serviceability and Durability.		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√		√	√		
CO2			√	√	√	
CO3		√	√		√	
CO4	√	√				
CO5		√			√	

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	1	1						1			1			
CO2	3	2	2	1					2			1			
CO3	3	1	1						1			1			
CO4	3	1	1						1			1			
CO5	3	1	1						1			1			

Modules	Teaching Hours	RBT Level

Module -1		
General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods, Quality assurance for concrete construction, as built concrete properties strength, permeability, thermal properties and cracking.	**08Hours**	**L1, L_4, L_5**
Module -2		
Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.	**08 Hours**	**L_3, L_4, L_5**
Module -3		
Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance, Preventive measures on various aspects. Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration, testing techniques.	**08 Hours**	**L_2, L_3. L5**
Module -4		
Materials for Repair: Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete. Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.	**08 Hours**	**L1, L_2**
Module -5		
Examples of Repair to Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies	**10 Hours**	**L_2, L_5**

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 10marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Sidney, M. Johnson "Deterioration, Maintenance and Repair ofStructures".
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific andTechnical
3. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie andSons
4. Raiker R.N., "Learning for failure from Deficiencies in Design, Constructionand Service"- R&D Center (SDCPL)

DESIGN OF TALL STRUCTURES
As per NEP, Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
SEMESTER – II

Course Code	23SEC242	IA Marks	50
Number of Lecture Hours/Week	03	Exam Marks	50
Total Number of Lecture Hours	42	Exam Hours	03

CREDITS – 03

Course objectives:

The objective of this course is to make students to learn principles of Structural Dynamics, To implement these principles through different methods and to apply the same for free and forced vibration of structures. To evaluate the dynamic characteristics of thestructures

Course Outcomes (COs):

On completion of this course,the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	AchieveKnowledgeof design a developmentofproblem-solvingskills.		
CO2	Understand the principles of strength and stability		
CO3	Design and develop analytical skills.		
CO4	Summarize the behavior of various structural systems.		
CO5	Understand the concepts of P-Delta analysis		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2	√		√	√	√	
CO3		√	√			
CO4		√	√	√		
CO5		√	√	√	√	

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	1	1						1			1			
CO2	3	2	2	1					2			1			
CO3	3	1	1						1			1			
CO4	3	1	1						1			1			
CO5	3	1	1						1			1			

Modules	Teaching Hours	RBT Level
Module -1		
Design Criteria: Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads.	**08Hours**	**L_1, L_2**
Module -2		
Wind loading: static and dynamic approach, Analytical and wind tunnel experimentation method. Calculation of design wind force. **Earthquake loading**: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.	**08 Hours**	**L_1, L_3, L_4, L_5**
Module -3		
Behavior of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Futigger– braced and hybrid mega system.	**08 Hours**	**L_2, L_3**
Module -4		
Analysis and Design: Modeling for approximate analysis, Assumptions, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift andtwist, computerized general three-dimensional Analyses. Design for differential movement, creep and shrinkage effects, temperature effects and fire.	**08 Hours**	**L_2, L_3, L_4**
Module -5		
Stability of Tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis, Transnational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation,	**10 Hours**	**L_2, L_3, L_4, L_5**

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 10marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from eachmodule.

REFERENCE BOOKS:

1. Taranath B.S, "Structural Analysis and Design of Tall Buildings"- McGrawHill
2. Wilf gang Schuller, "High rise building structures"- JohnWiley
3. Bryan Stafford Smith &Alexcoull, "Tall building structures Analysis and Design"- JohnWiley
4. T.Y Lin &D.Stotes Burry, "Structural concepts and system for Architects and Engineers"- JohnWiley
5. Lynn S.Beedle, "Advances in Tall Buildings"- CBS Publishers andDistributors.
6. Dr. Y.P. Gupta – Editor, "Proceedings National Seminar on High Rise Structures- Design and Construction practices for middle level cities"- New Age InternationalLimited

ADVANCED CIVIL ENGINEERING WORKSHOP

As per NEP, Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

SEMESTER – II

Course Code	23CSEL25	**CIE**	50
Number of Lecture Hours/Week	03	**SEE**	50
Total Number of Lecture Hours	20	**Exam Hours**	03

CREDITS – 01

Course objectives:

The objectives of this course are,

1. To make students to learn construction principles of structures.
2. To visit different types of structures and detailing of the structures.
3. Understand the various materials required for different construction activities.

Course Outcomes(COs):

On completion of this course, the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	To develop basic technical knowledge of construction activities.		
CO2	Apply basic techniques for masonry and concrete related works.		
CO3	Identifying appropriate material required for each activity.		
CO4	To observe technical aspects involved in workmanship of various tasks.		
CO5	To observe technical aspects involved in safety precautions.		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√		
CO2	√	√	√	√	√	
CO3	√	√	√	√		
CO4				√	√	
CO5	√	√		√		

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	3	2	1					1			1	3		
CO2	3	3	3	1	1				1			1	3		
CO3	3	3	3	2	1				1			1	3		
CO4	3	2	3	2					1			1	3		
CO5	3	2	3	1					1			2	3		

Note: 1-Low, 2-Medium, 3-High

Modules	Teaching Hours	RBT Level
Module -1		
Preparation of Drawing using AUTOCAD: Plan, Beam and Column marking, Elevation, Section and detailing with mark out.	**04 Hours**	**L_3**
Module -2		
Visit anearbysitewhereconstructionisatinitialstageand observe for following (if necessary, visit two/threetimes with a gap of a week). If drawings are availablerelate/matchactivitieswiththe drawings. (a) Diggingandfilling (b) Foundationpreparations (c) Brick/stonemasonry (d) ConcretelayingandCuring (e) Layingofsewerage/sanitarylines (f) Barbendingandbarlayingforcolumns,beams,andceiling. (g) Onsitetestingforquality Prepareabriefreportonconstructionactivities observedandmethods,tools,equipment,andmaterialsbeingused.	**06 Hours**	**L4**
Module -3		
Building materials, Construction tools and safety instruments.	**03 Hours**	**L_2**
Module -4		
Estimation, costing and specification of various building.	**03 Hours**	**L_2**
Module -5		
Industrial visit and case studies.	**04 Hours**	**L_2**

STRUCTURAL ANALYSIS AND DESIGN LAB - II
As per NEP, Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
Semester– II

Course Code	23CSEL26	**CIE**	50
Number of Lecture Hours/Week	03	**SEE**	50
Total Number of Lecture Hours	20	**Exam Hours**	03

CREDITS – 01

Course objectives: The objective of this course is to make students to learn design principles of structure, design different types of structures and detailing of the structures. To evaluate performance of thestructures.

Course Outcomes (COs):

On completion of this course, the student will be able to

CO#	Course Outcomes	POs	PSOs
CO1	Revit for architectural BIM Services is improved design and visualization.		
CO2	It helps architects identify design flaws and adjust before the construction phase begins.		
CO3	It also offers design analysis and simulation capabilities allowing architects to evaluate the building's performance.		
CO4	It allows architects to create detailed building designs, visualize the project in 3D.		
CO5	It allows to produce detailed documentation and construction drawings		

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√				
CO2	√	√				
CO3	√	√				
CO4	√	√				
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO 1	PSO 2	PSO 3
CO1	3				3				2			2	3		
CO2	3				3				2			2	3		
CO3	3				3				2			2	3		
CO4	3				3				2			2	3		

CO5	3	2			3				2			2	3		

Note: 1-Low, 2-Medium, 3-High

Modules	Teaching Hours	RBT Level
Module -1		
INTRODUCTION TO REVIT: Introduction- Proprietary and open software -basic drawing and editing tools- file import- setting up units, levels and grids – working with a project- drawing and modifying walls- wall shapes and openings – plastering skirting and dado wall sweep and wall revel- wall layers- stacked wall – dimensions and measurements adding loading and creating doors and windows wall opening	**4 Hours**	**L_1, L_2**
Module -2		
WORKING WITH COMPONENTS: Adding furniture and fixtures to a project – working with components – creating interior elevations – adding lighting fixtures.	**4 Hours**	**L_1, L_2**
Module -3		
VIEWS AND ELEVATIONS: - creating building section – site Design and modifying topo surfaces-site components farming plans and elevation with views. Adding sun setting – applying materials.	**4 Hours**	**L_1, L_2**
Module -4		
RENDERING AND WALKTHROUGH: placing of camera – adding suitable walkthrough selecting and placing all the viewpoints – working with rendered file schedule – BIM management.	**4Hours**	**L_1, L_2**
Module -5		
WORKING WITH COST & ESTIMATION: cost analysis – components and materials – estimation on structure – simulation buildings quantity take-off	**4 Hours**	**L_1, L_2, L3**

REFERENCE BOOKS:

1. 1. Autodesk Revit for Architecture Certified User Exam Preparation (Revit 2024 Edition) Available January 23, 2024By Daniel John Stine AIA, IES, CSI, CDT, Well AP
2. 2.Autodesk Revit 2024 Architecture Certified Professional Exam Study Guide Published October 11, 2023By Elise Moss
3. 3. Interior Design Using Autodesk Revit 2024Published July 27, 2023By Daniel John Stine AIA, IES, CSI, CDT, Well AP
4. 4. Commercial Design Using Autodesk Revit 2024Published July 10, 2023By Daniel John Stine AIA, IES, CSI, CDT, Well AP.