3rd Semester- Scheme

(M.Tech – Structural Engineering)

Third Semester

S.No.	Course Code	Course Title	Hrs./ Week			Credits
			L	T	P	
1	PSEC – MTSE301	Elective - IV	3	0	0	3
2	LLC –MTSE301	Personality Development	1	0	0	1
3	SBC – MTSE301	Dissertation Part - I	0	0	20	10
Total Credits						**14**

	Elective-IV (PSEC – MTSE301)
(A)	Massive Open Online Course - I
(B)	Design of Masonry Structures
(C)	Prefabricated Structures
(D)	Design of Tall Structures

PSEC-MTSE301 (B)	Design of Masonry Structures	3L:0T:0P (Hrs)	3 Credits

Objective: The objective of this course is to make students to learn performance of masonry structures, To design the masonry structures for earthquake resistance. To evaluate the strength and stability of the masonry structures.

Module 1 Introduction, Masonry units, materials and types (10 Hrs)

History of masonry Characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units – strength, modulus of elasticity and water absorption. Masonry materials – Classification and properties of mortars, selection of mortars.

Module 2 Strength of Masonry in Compression (10 Hrs)

Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, Failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength

Module 3 Flexural and shear bond, flexural strength and shear strength (10 Hrs)

Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength

Module 4 Design of load bearing masonry buildings (10 Hrs)

Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall; Design of load bearing masonry for buildings up to 3 to 8 storeys using BIS codal provisions

Module 5 Earthquake resistant masonry buildings (10 Hrs)

Behaviour of masonry during earthquakes, concepts and design procedure for earthquake

resistant masonry, BIS codal provisions. Masonry arches, domes and vaults: Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure

Course Outcomes:

Students will be able to

CO1. Achieve knowledge of design and development of problem solving skills.

CO2. Understand the principles of design and construction of masonry structures.

CO3. Design and develop analytical skills.

CO4. Summarize the masonry Characteristics.

CO5. Evaluate the strength and stability of the masonry structures.

Text/Reference Books:

1. Hendry A.W., "Structural masonry"- Macmillan Education Ltd., 2nd edition
2. Sinha B.P & Davis S.R., "Design of Masonry structures"- E & FN Spon
3. Dayaratnam P, "Brick and Reinforced Brick Structures"- Oxford & IBH
4. Curtin, "Design of Reinforced and Prestressed Masonry"- Thomas Telford
5. Sven Sahlin, "Structural Masonry"-Prentice Hall
6. Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, "Alternative Building Materials and Technologies"-New Age International, New Delhi & Bangalore
7. IS 1905, BIS, New Delhi.
8. SP20(S&T),New Delhi

PSEC-MTSE301 (C)	Prefabricated Structures	3L:0T:0P (Hrs)	3 Credits

Objective: To get introduced to the concepts of prefabrication, types and its systems. To have a knowledge about the structural behaviour of prefabricated structures. To obtain knowledge in design of cross section and the joints in structures. To have a detailed knowledge in designing and detailing of various prefabricated units. To possess a comprehensive knowledge in design of structures subjected to earthquake.

Module 1 Fundamentals of Prefabricated Structures (10 Hrs)

Types of prefabrication, prefabrication systems and structural schemes - Need for prefabrication - Principles - Materials - Disuniting of structures - Handling and erection - Elimination of erection stresses.

Module 2 Prefabricated Components (10 Hrs)

Production, Transportation & erection- Shuttering and Mould design - Dimensional tolerances - Erection of R.C. Structures, Total prefabricated buildings - Structural behaviour of precast structures - Large panel constructions - Construction of roof and floor slabs - Wall panels - Columns - Shear walls.

Module 3 Design Principles (10 Hrs)

Design of cross section based on efficiency of material used - Problems in design - joint flexibility - Allowance for joint deformation - Design of expansion joints.

Module 4 Structural Members (10 Hrs)

Design and detailing of boot reinforcement in beams, composite plank floor and corbel - Dimensioning and detailing of joints for different structural connections - industrial structures and water tanks.

Module 5 Design for Abnormal Loads (10 Hrs)

Progressive collapse - Codal provisions Equivalent design loads for considering abnormal effects such as earthquakes, cyclones. Structural Integrity – alternate load path.

Course Outcomes:

Students will be able to

CO1. Apply the basic knowledge of prefabrication in construction industry.

CO2. Analyze the behaviour of prefabricated structures.

CO3. Design the cross section and joints of prefabricated units.

CO4. Apply the knowledge of prefabrication in designing and detailing of prefabrication units.

CO5. Design the structures for abnormal loads using the codal provisions.

Text/Reference Books:

1. Hass, A.M. (1983), Precast Concrete, Design and Applications, Taylor & Francis, UK.
2. Phillips, W.R. and Sheppard, D.A. (1980), Plant cast, Precast and Prestressed Concrete, McGraw Hill, New York.
3. A.S.G Bruggeling, G.F Huyghe, "Prefabrication with Concrete", CRC Press, January 1991
4. IS 8916, " Building Design & Erection Using Prefabricated Concrete" , 208
5. R.L Gilbert, N.C Mickeborough, " Design of Prestressed Concrete", Taylor & Francis
6. Architectural Precast Concrete, Prestressed Concrete Institute, third edition 2007
7. Kim S. Elliott , Colin Jolly, "Multi-Storey Precast Concrete Framed Structures". Wiley-Blackwell, 2014.
8. Gerostiza C.Z., Hendrikson C. and Rehat D.R., "Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994.
9. Haas, A.M. "Precast Concrete Design and Applications", CRC Press Publishers, 1990.
10. Promislow, V "Design and Erection of Reinforced Concrete Structures", MIR Publishers, Moscow 1986.
11. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete", Netherland BetorVerlag, 1978.
12. Koncz T., "Manual of precast concrete construction", Vols. I, II and III, Bauverlag, GMBH, 1971.
13. MOKK, Laszlo, "Prefabricated concrete for industrial and public structures", C. R. Books, 1964.

PSEC-MTSE301 (D)	Design Of Tall Structures	3L:0T:0P (Hrs)	3 Credits

Objectives: The objective of this course is to make students to learn principles of stability of tall buildings, To design the tall buildings for earthquake and wind resistance. To evaluate the performance of tall structures for strength and stability

Module 1 Design Criteria: **(8 Hrs)**

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.

Module 2 Wind loading: **(8 Hrs)**

Static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.

Module 3 Behavior of Various Structural Systems: **(8 Hrs)**

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, Outrigger – braced and hybrid mega system.

Module 4 Analysis and Design: **(8 Hrs)**

Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist, computerized general three dimensional analyses.

Module 5 Stability of Tall Buildings: **(8 Hrs)**

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 plum effects, stiffness of member in stability, effect of foundation rotation. Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire

Course outcomes:

On completion of this course, students are able to:

CO1. Achieve Knowledge of design and development of problem solving skills.

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 buckling analysis of frames.

Text/Reference Books:

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