PAAVAI ENGINEERNG COLLEGE

(Autonomous)

M.E. - STRUCTURAL ENGINEERING

REGULATIONS 2023

(CHOICE BASED CREDIT SYSTEM)

CURRICULUM

(For the candidates admitted during the Academic Year 2023 - 24 onwards)

SEMESTER I

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	FC	PMA23102	Advanced Mathematical Methods	3	1	0	4
2	MC	PEN23101	Research Methodology and IPR	3	0	0	3
3	PC	PSE23101	Matrix methods of structural analysis	3	1	0	4
4	PC	PSE23102	Theory of Elasticity and Plasticity	3	0	0	3
5	PC	PSE23103	Advanced Design of Reinforced Concrete Structures	3	0	0	3
6	PE	PSE23* **	Professional Elective I	3	0	0	3
7	AC	PAC23101	English for Research Paper Writing (Audit Course I)	2	0	0	0
Practical							
8	PC	PSE23104	Advanced Structural Engineering Laboratory	0	0	4	2
			TOTAL	**20**	**2**	**4**	**22**

SEMESTER II

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	PSE23201	Experimental Techniques and Instrumentation	3	1	0	4
2	PC	PSE23202	Structural Dynamics	3	0	0	3
3	PC	PSE23203	Advanced Steel Structures	3	0	0	3
4	PC	PSE23204	Finite Element Method	3	0	0	3
5	PE	PSE23***	Professional Elective II	3	0	0	3
6	PE	PSE23***	Professional Elective III	3	0	0	3
7	AC	PAC23201	Pedagogy Studies (Audit Course II)	2	0	0	0
Practical							
8	PC	PSE23205	Structural Design Studio	0	0	4	2
			TOTAL	**20**	**1**	**4**	**21**

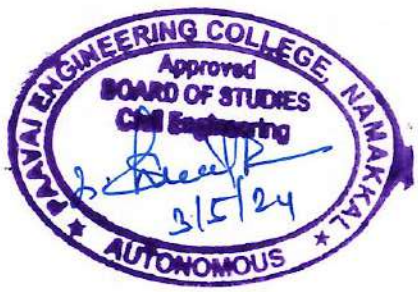
SEMESTER III

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	PSE23301	Advanced Prestressed Concrete Structures	3	0	0	3
2	PE	PSE23***	Professional Elective IV	3	0	0	3
3	OE	PSE23901	Open Elective I	3	0	0	3
Practical							
4	EE	PSE23302	Practical Training (4 weeks)	0	0	2	1
5	EE	PSE23303	Technical Seminar	0	0	2	1
6	EE	PSE23304	Project Work (Phase I)	0	0	12	6
			TOTAL	**9**	**0**	**16**	**17**

SEMESTER IV

S.No.	Category	Course Code	Course Title	L	T	P	C
Practical							
1	EE	PSE23401	Project Work (Phase II)	0	0	24	12
			TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS: 72



LIST OF PROFESSIONAL ELECTIVES

S.NO	Category	Course Code	Course Title	L	T	P	C
1	PE	PSE23151	Structural Optimization	3	0	0	3
2	PE	PSE23152	Fracture Mechanics	3	0	0	3
3	PE	PSE23153	Advanced Concrete Technology	3	0	0	3
4	PE	PSE23154	Corrosion Engineering	3	0	0	3
5	PE	PSE23155	Design of Bridge Structures	3	0	0	3
6	PE	PSE23156	Structural Health Monitoring	3	0	0	3
7	PE	PSE23157	Performance of structures with Soil-Structure Interaction	3	0	0	3
8	PE	PSE23158	Rehabilitation and Retrofitting of Structures	3	0	0	3
9	PE	PSE23159	Design of Sub Structures	3	0	0	3
10	PE	PSE23160	Mechanics of Composite Materials	3	0	0	3
11	PE	PSE23161	Design of Shell and Spatial structures	3	0	0	3
12	PE	PSE23162	Design of Offshore Structures	3	0	0	3
13	PE	PSE23163	Industrial Structures	3	0	0	3
14	PE	PSE23164	Prefabricated Structures	3	0	0	3
15	PE	PSE23165	Design of Formwork	3	0	0	3
16	PE	PSE23166	Analysis and Design of Tall Buildings	3	0	0	3
17	PE	PSE23167	Stability of Structures	3	0	0	3
18	PE	PSE23168	Energy Efficient Buildings	3	0	0	3
19	PE	PSE23169	Earthquake Analysis and Design of Structures	3	0	0	3
20	PE	PSE23170	Wind and Cyclone Effects on Structures	3	0	0	3

OPEN ELECTIVE I

S.NO	Category	Course Code	Course Title	L	T	P	C
1	OE	PSE23901	Climate change and Adaptation	3	0	0	3
2	OE	PED23901	Industrial Safety	3	0	0	3
3	OE	PCS23901	Design of Digital Elements	3	0	0	3
4	OE	PCE23901	Big Data Analytics	3	0	0	3
5	OE	PPS23901	Alternate Energy Sources	3	0	0	3

PSE23301	ADVANCED PRESTRESSED CONCRETE STRUCTURES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the basic principles of prestressed concrete structures.
2	discuss the flexure and shear design for prestressed concrete elements.
3	find the factors influencing deflection and anchorage zone design.
4	recognize the performance of composite and continuous members.
5	demonstrate various prestressed concrete structural elements.

UNIT I	PRINCIPLES OF PRESTRESSED CONCRETE STRUCTURES	9

Historical developments; Basic principles of prestressing; Classification and types; Advantages over ordinary reinforced concrete; Materials – High strength concrete, High tensile steel; Systems and Methods of prestressing; Analysis of sections- stress concept, strength concept and load balancing concept; Losses of prestress in post-tensioned and pre-tensioned members; Comparison of codal provisions.

UNIT II	DESIGN FOR FLEXURE AND SHEAR	9

Basic assumptions for calculating flexural stresses; Permissible stresses in steel and concrete as per I.S.1343 Code; Design of sections of Type I, II and III post – tensioned and pre–tensioned beams; Check for strength limit based on I.S. 1343 Code; Design for shear based on I.S. 1343 Code.

UNIT III	DEFLECTION AND DESIGN OF ANCHORAGE ZONE	9

Deflection – Factors influencing deflections; Effect of tendon profile on deflections; Short and long term deflections; Check for serviceability limit state of deflection; Anchorage zone – Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code; Design of anchorage zone reinforcement.

UNIT IV	COMPOSITE BEAMS AND CONTINUOUS BEAMS	9

Analysis and design of composite beams; Shrinkage strain and its importance; Methods of achieving continuity in continuous beams; Analysis for secondary moments; Concordant cable and linear transformation; Calculation of stresses; Principles of design.

UNIT V	SPECIAL STRUCTURES	9

Design of tension and compression members; Design of tanks, pipes, poles and sleepers; Partial pre-stressing – Definition, methods of achieving partial pre-stressing, merits and demerits of partial pre-stressing

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	interpret the various types of prestressing methods.	Understanding (K2)
CO2	determine the flexure and shear on prestessed concrete elements.	Applying (K3)

CO3	compute of anchorage zone reinforcement.	Applying (K3)
CO4	identify composite and continuous beams.	Analyzing (K4)
CO5	examine the various prestressed concrete structural elements.	Analyzing (K4)

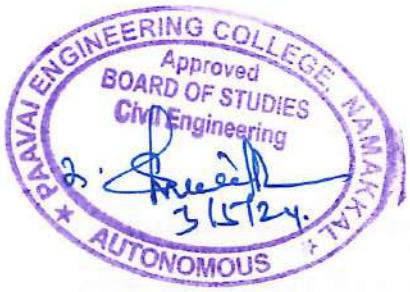
REFERENCES

1. Rajagopalan.N, Prestressed concrete, Narosa Publishing House, 2020.
2. Pandit.G.S. and Gupta.S.P., "Prestressed concrete", CBS Publishers and Distributors Pvt Ltd, Second Edition, 2019.
3. Krishna Raju N., "Prestressed concrete", Tata McGraw Hill Company, Fifth Edition, 2018.
4. Dayaratnam.P and Sarah.P, "Prestressed concrete Structures", Wiley India Pvt Ltd, New Delhi, 2013.
5. IS1343 – 2012 – IS Code of Practice for Prestressed concrete.
6. IS748 – 2001 – Part III - IS Specification for Prestressed Concrete Pipes.
7. IS3370 – 2021 – Part III - IS Code of Practice for Concrete Structures for the storage of liquids.
8. IS678 – 1998 – Specification for Prestressed Concrete Poles for overhead Power Traction and Telecommunication lines.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's					
	1	2	3	4	5	6
CO1	2	-	3	2	3	2
CO2	3	-	2	2	2	3
CO3	2	-	3	2	3	3
CO4	2	-	1	2	2	3
CO5	1	-	2	2	3	2



PSE23302	PRACTICAL TRAINING (4 weeks)	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	train the students in the field work so as to have firsthand knowledge of practical problems related to Structural Engineering in carrying out engineering tasks.
2	develop skills in facing and solving the field problems.

SYLLABUS

The students individually undertake training in reputed engineering companies doing Structural Engineering during the summer vacation for a specified duration of four weeks. At the end of the training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL PERIODS	**30**

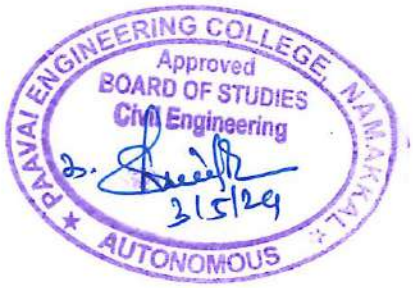
COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	describe the Structural Engineering organization.	Understanding (K2)
CO2	identify Concepts of development and implementation of new techniques.	Analyzing(K4)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's					
	1	2	3	4	5	6
CO1	2	2	2	2	3	2
CO2	2	2	2	3	2	2



PSE23303	TECHNICAL SEMINAR	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	work on a specific technical topic in Structural Engineering in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.
2	acquire technical writing abilities for seminars, conferences and journal publications

SYLLABUS

The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to Structural Engineering and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as the audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

TOTAL PERIODS	**30**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	identify the latest developments in the field of Structural Engineering	Remembering (K1)
CO2	ensure the use of contemporary instruments to provide technical knowledge and conduct compression and tension tests on springs..	Analyzing (K4)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's					
	1	2	3	4	5	6
CO1	2	2	2	2	3	2
CO2	2	2	2	3	2	2

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Civil Engineering
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PSE23304	PROJECT WORK (PHASE I)	0	0	12	6

COURSE OBJECTIVES

To enable the students to

1.	develop the fundamental knowledge for understanding state of the art information about any topic relevant to curriculum.
2.	develop the technical skill sets in the chosen field and also to accustom to research orientation.
3.	develop the methodology to solve the identified problem.
4.	train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS

The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of Structural Engineering. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL PERIODS:	**180**

COURSE OUTCOMES At the end of the course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	reviewed Civil Engineering problems available in literature.	Analyzing (K4)
CO2	conduct experiments / Design and Analysis / solution iterations and document the results in the form of technical report / presentation.	Applying (K3)
CO3	undertake problem identification, formulation and solution.	Applying (K3)
CO4	design engineering solutions to complex problems utilising a systems approach	Applying (K3)

CO - PO MAPPING

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	2	2	2
CO2	2	3	3	2	2	2
CO3	2	3	3	2	2	2
CO4	2	3	3	2	2	2

PSE23401	PROJECT WORK (PHASE II)	0	0	24	12

COURSE OBJECTIVES

To enable the students to

1.	carry out analytical and / or experimental research oriented work in the field of Structural Engineering.
2.	the project aims to provide an opportunity of designing and building complete system or subsystems based on area where the students like the acquire specialized skills.
3.	solve the identified problem based on the formulated methodology.
4.	develop skills to analyze and discuss the test results, and make conclusions.

SYLLABUS

The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report submitted and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL PERIODS:	**360**

COURSE OUTCOMES At the end of the course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	demonstrate any challenging practical problem and final better solutions.	Applying (K3)
CO2	apply engineering and management principles through efficient handling of project have a clear idea of his/her area of work and they are in a position to carry out the work in a systemic way	Applying (K3)
CO3	design engineering solutions to complex problems utilising a systems approach	Applying (K3)
CO4	analyze and prepare the report for a given project, write and present technical paper based on the research work.	Analyzing (K4)

CO - PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	3	3	2
CO2	2	3	2	3	3	2
CO3	2	3	2	3	3	2
CO4	2	3	2	3	3	2

PSE23163	INDUSTRIAL STRUCTURES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	know about various general requirements of industries
2	impart a broad knowledge about functional requirements for industrial structures
3	understand the design concepts of RC structures
4	understand the concepts of gantry girders, steel bunkers of industrial building
5	gain the knowledge on pre-engineered buildings

UNIT I	INTRODUCTION TO INDUSTRIAL STRUCTURES	9

Classification of Industries and Industrial Structures - Specific requirements for Industries like Engineering, Textiles, Chemicals; Site layout and external facilities required.

UNIT II	FUNCTIONAL REQUIREMENTS	9

Nature and artificial lighting protection from the sun light - Services Electrical wiring fixtures, cable and pipe bridge, Electrical installation, substations, Effluent disposal, Heating and Ventilation, Air conditioning; Fire expanse and chutes - fire alarm, extinguishers and hydrants ; Guidelines from factories act

UNIT III	DESIGN OF RC STRUCTURES	9

Design and detailing of R.C. gable frames, corbels and nibs, bunkers, silos, R.C.C chimney, Principles of folded plates and shell roofs.

UNIT IV	DESIGN OF STEEL STRUCTURES	9

Design of Gantry girders; Steel chimneys; Steel Bunker and Silo.

UNIT V	PREENGINEERED BUILDINGS	9

Prefabricated building - Advantages and Disadvantages, Primary and secondary structural elements, foundation, wall materials, metal roofing.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	describe the various specific requirements of industries.	Understanding (K2)
CO2	determine the functional requirements of various industries.	Applying (K3)
CO3	compute various RC structures.	Applying (K3)
CO4	identify the components of girder, chimneys and silo.	Applying (K3)
CO5	describe about pre-engineered buildings.	Understanding (K2)

REFERENCES

1. Subramanian N., "Design of Steel Structures", 3rd Edition, Oxford University Press, 2011.

2. Dayaratnam, P., "Design of Steel Structures", A.H. Wheeler & Co., Ltd., Allahabad, 2008.
3. Srinivasulu P and Vaidyanathan.C, "Handbook of Machine Foundations", Tata McGraw Hill, 2004.
4. Jurgen Axel Adam, KatharriaHausmann, Frank Juttner, Klauss Daniel, "Industrial Buildings: A Design Manual", Birkhauser Publishers, 2004.
5. IS 6060 -1971 - Code of practice for Day lighting of factory buildings
6. IS 3103 -1975- Code of practice for industrial ventilation
7. IS 3483 -1965 - Code of practice for Noise reduction in industrial buildings
8. IS 6533 (Part 1 &Part 2) -1989 - Code of practice for design and construction of steel chimneys
9. IS:875 (Part 1 to 5) - Code of Practice for Design loads.
10. IS:9178-1980 - Criteria for Design of Steel Bins for Storage of Bulk Materials
11. IS: 3370-1967 - Part 2 to 4 - Code of Practice for Concrete Structures for the storage of liquids - Reinforced Concrete Structures.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's					
	1	2	3	4	5	6
CO1	3	-	1	2	3	3
CO2	2	-	2	2	3	2
CO3	2	-	1	2	3	3
CO4	2	-	1	2	3	2
CO5	2	-	2	2	2	3

PSE23164	PREFABRICATED STRUCTURES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	impart the basic knowledge about prefabrication.
2	know about the different types of connection.
3	understand the design for stripping forces during manufacture.
4	know about the forces in shear walls.
5	understand the different roof trusses used in industrial buildings.

UNIT I	DESIGN PRINCIPLES	9

General Civil Engineering requirements - specific requirements for planning and layout of prefabrication plant. IS Code specifications; Modular co-ordination; standardization; Disuniting of Prefabricates; Production, transportation, erection, stages of loading and code provisions, safety factors, material properties, Deflection control.

UNIT II	REINFORCED CONCRETE	9

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls; Connections - Beam to column and column to column.

UNIT III	FLOORS, STAIRS AND ROOFS	9

Types of floor slabs - analysis and design example of cored and panel types and two-way systems, Design analysis for product manufacture, handling and erection, staircase slab, types of roof slabs and insulation requirements, Description of joints, their behavior and reinforcement requirements, Deflection control for short term and long-term loads, Ultimate strength calculations in shear and flexure.

UNIT IV	WALLS	9

Types of wall panels - Blocks and large panels, Curtain, Partition and load bearing walls, Hoisting and placing, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behavior and design, Leak prevention, joint sealants, sandwich wall panels, Lateral load resistance, Location and types of shear walls, approximate design of shear walls

UNIT V	INDUSTRIAL BUILDINGS AND SHELL ROOFS	9

Components of single - storey industrial sheds with crane gantry systems, R.C. Roof Trusses, Roof Panels, corbels and columns, wind bracing; Cylindrical - Folded plate and paraboloid shells, Erection and jointing of components in industrial buildings.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	explain the design principles involved in prefabrication.	Understanding (K2)
CO2	detail the different types of connection.	Understanding (K2)
CO3	compute for stripping forces during manufacture.	Applying (K3)

CO4	determine the forces in shear walls.	Applying (K3)
CO5	identify the different roof trusses used in industrial buildings.	Analyzing (K4)

REFERENCES

1. Precast Concrete Structures, Precast Concrete Structures, Second Edition by Kim S. Elliott, CRS Publishers, 2016.
2. Hubert Bachmann and Alfred Steinle , Precast Concrete Structures, 2012.
3. Donald Watson and Michael J.Crosbie, "Time Saver Standards for Architectural Design",8th Edition, Tata McGraw Hill Edition, 2011.
4. Walter Martin Hosack, "Land Development Calculations", McGraw Hill 2nd Edition, USA 2010.
5. IS 15916:2011 - Building Design And Erection Using prefabricated Concrete
6. IS 11447: 1985 - Code of practice for construction with large panel prefabricates.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's					
	1	2	3	4	5	6
CO1	2	1	1	2	3	1
CO2	2	1	1	2	2	-
CO3	2	1	2	2	3	1
CO4	2	1	1	3	3	-
CO5	2	1	2	2	3	1

PSE23165	DESIGN OF FORMWORK	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	select proper formwork, accessories and material.
2	analyze the formwork for beams, slabs, columns, walls and foundations.
3	understand the formwork design for special structures.
4	manage the working of flying formwork.
5	judge the formwork failures through case studies.

UNIT I	INTRODUCTION TO FORMWORK	9

Requirements and Selection - Formwork materials - Timber, Plywood, Steel, Aluminum, Plastic and Accessories - Horizontal and Vertical Formwork supports.

UNIT II	FORMWORK DESIGN	9

Design Concepts - Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.

UNIT III	FORMWORK DESIGN FOR SPECIAL STRUCTURES	9

Design and Details of Special Structures - Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

UNIT IV	FLYING FORMWORK	9

Table Form, Tunnel Form, Slip Form - Formwork for Precast Concrete, Formwork Management Issues - Pre and Post Award.

UNIT V	FORMWORK FAILURES	9

Causes - Case studies in Formwork Failure, Formwork Issues in Single and Multi - Story Building Construction.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	examine proper formwork, accessories and material.	Analyzing (K4)
CO2	compute the formwork for beams, slabs, columns, walls and foundations	Applying (K3)
CO3	determine the formwork for special structures.	Applying (K3)
CO4	explain the formwork management issues.	Understanding (K2)
CO5	solve the formwork failures through case studies.	Remembering (K1)

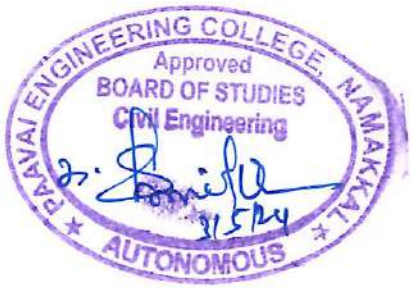
REFERENCES

1. Robert I. PeurifoyGarold D. Oberlender "Formwork for Concrete structures"Mc Graw Hill India, 2010.
2. Formwork for Concrete Structurs, Kumar Neerajha, Tata McGraw Hill Education, 2012.
3. IS 14687:1999, False work for Concrete Structures - Guidelines, BIS.
4. IRC 87 - 2011- Guidelines on formwork, false work and temporary structures.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's					
	1	2	3	4	5	6
CO1	1	-	1	3	3	1
CO2	1	-	1	2	2	2
CO3	2	-	2	2	3	1
CO4	1	-	1	3	3	3
CO5	1	-	2	3	3	1



PSE23166	ANALYSIS AND DESIGN OF TALL BUILDINGS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	introduce the loading condition on high rise buildings.
2	gain knowledge on power transmission structures.
3	gain on power plant structures.
4	explain the design of foundation for towers.
5	familiar with analysis and design of high rise buildings:

UNIT I	LOADING OF HIGH RISE BUILDINGS	9

Loading- sequential loading, Gravity loading, Wind loading, Earthquake loading, - Equivalent lateral force, modal analysis - combination of loading, - Static and Dynamic approach - Analytical and wind tunnel experimental methods - Design philosophy - working stress method, limit state method and plastic design.

UNIT II	POWER TRANSMISSION STRUCTURES	9

Cables -Transmission line towers, Substation Structures; Tower foundations; Testing towers.

UNIT III	POWER PLANT STRUCTURES	9

Chimneys and Cooling Towers - High pressure boilers and piping design - Nuclear containment structures

UNIT IV	FOUNDATION	9

Design of foundation for Towers, Chimneys and Cooling Towers - Machine Foundation - Design of Turbo Generator Foundation.

UNIT V	ANALYSIS AND DESIGN OF HIGH RISE BUILDINGS	9

Modeling for analysis - Assumptions - Modeling for approximate analyses -Modeling for accurate analysis -Reduction techniques - Dynamic analysis - Response to wind loading - Along-wind response- Across - wind response - Estimation of natural frequencies and damping - Types of excitation Design to minimise dynamic response - Response to earthquake motions - Response to ground accelerations - Response spectrum analysis - Estimation of natural frequencies and damping Human response to building motions.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	examine the concept for various structures subjected to wind.	Analyzing (K4)
CO2	identify the transmission line towers and foundations.	Applying (K3)
CO3	Determine the and design chimneys as per codal provisions.	Applying (K3)
CO4	infer with all types of machine foundations.	Understanding (K2)
CO5	describe the various structural systems used in the construction of tall structures.	Understanding (K2)

REFERENCES

1. Rolf Katzenbach, Steffen Leppla, et al.., "Foundation systems for High rise structures", CRC Press, 2016.
2. Gupta.Y.P.,(Editor), Proceedings of National Seminar on High Rise Structures- Design and Construction Practices for Middle Level Cities, New Age International Limited, New Delhi,2015.
3. Taranath B.S., "Structural Analysis and Design of Tall Buildings", McGrawHill, 2011.
4. Santhakumar, A.R. and Murthy, S.S., "Transmission Line Structures", Tata McGraw Hill 2011.
5. IS 6060 -1971 - Code of practice for Day lighting of factory buildings
6. IS 3103 -1975- Code of practice for industrial ventilation
7. IS 3483 -1965 - Code of practice for Noise reduction in industrial buildings
8. IS 6533 (Part 1 & Part 2) -1989 - Code of practice for design and construction of steel chimneys
9. IS:875 (Part 1 to 5) - Code of Practice for Design loads
10. IS:802-1977(Part 2) - Code of practice for use of structural steel in Over Head transmission line towers
11. IS:4091-1979 - Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's					
	1	2	3	4	5	6
CO1	1	-	1	3	3	3
CO2	1	-	1	2	3	2
CO3	2	-	2	2	2	1
CO4	1	-	1	3	3	1
CO5	2	-	2	2	3	3

PSE23167	STABILITY OF STRUCTURES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the basic concepts and approximate methods of stability.
2	study the stability of columns using theoretical and numerical methods.
3	enumerate the lateral buckling, lateral torsional buckling and flexural torsional buckling of beams.
4	study various numerical techniques and energy methods for buckling of thin plates.
5	get accustomed to beam column joint behaviour and that of frames.

UNIT I BUCKLING OF COLUMNS **9**

States of equilibrium - Concept of equilibrium, energy, imperfection and vibration approaches to stability analysis - Governing equation for column buckling - Critical load using Equilibrium; Energy methods - Approximate methods - Rayleigh-Ritz; Galerkins approach - Numerical techniques – Finite difference method.

UNIT II BUCKLING OF BEAM-COLUMNS AND FRAMES **9**

Theory of beam-column - Stability analysis of beam-column with single and several concentrated loads, distributed load and end couples - Analysis of rigid jointed frames with and without sway; Use of stability function to determine the critical load.

UNIT III TORSIONAL AND LATERAL BUCKLING **9**

Torsional buckling - Combined torsional and flexural buckling, Local buckling - Buckling of open sections, Lateral buckling of beams, Simply supported and cantilever beams.

UNIT IV BUCKLING OF PLATES **9**

Governing differential equation - Buckling of thin plates with various edge conditions, Analysis by equilibrium and energy approach, Finite difference method.

UNIT V INELASTIC BUCKLING **9**

Double modulus theory - Tangent modulus theory; Shanley's model; Eccentrically loaded inelastic column; Inelastic buckling of plates - Post-buckling behaviour of plates.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	calculate the buckling load on column by various approaches	Applying (K3)
CO2	estimate the buckling load of beam-columns and frames	Understanding (K2)
CO3	explore the concepts of torsional and lateral buckling of thin-walled members	Analyzing (K4)
CO4	explain the phenomenon of buckling of plates	Analyzing (K4)
CO5	determine the inelastic buckling of columns and plates	Applying (K3)

REFERENCES

1. Ashwini Kumar, "Stability Theory of Structures", Allied publishers Ltd., New Delhi, 2003.
2. Chajes A., "Principles of Structures Stability Theory", Prentice Hall, 1974.
3. Gambhir M. L., "Stability Analysis and Design of Structures", Springer, New York, 2013.
4. Timoshenko S. P. and Gere J. M., "Theory of Elastic Stability", McGraw Hill Book Company, 2012.

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CO1	2	-	2	3	2	3
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CO3	2	-	2	2	3	1
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CO5	1	-	2	2	2	3

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PSE23168	ENERGY EFFICIENT BUILDINGS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	study the Energy consumption pattern of various types of buildings.
2	learn the various environmental factors affecting the building design.
3	gain knowledge on thermal performance of materials used in the building.
4	employ the energy efficient and energy conservation concepts with energy auditing.
5	understand about Energy auditing of buildings.

UNIT I	INTRODUCTION TO ENERGY	9

Energy- Power - Need of energy in buildings and its assessment; Energy consumption pattern of various types of buildings; Factors influencing the energy use in building; Concepts of energy efficient building - Rebound effect and Energy efficient buildings in India.

UNIT II	STUDY OF CLIMATE	9

Study of Weather and Climate – Classification of climate for various zones - Influence of climate in building design; Tropical climate – Orientation; Environmental factors affecting building design; Analysis of thermal and visual environment.

UNIT III	HEAT AND LIGHT	9

Heat gain and heat loss phenomenon in buildings; Thermal performance parameters; Role of building enclosures - openings and materials in thermal environment; Basic principles of light and daylight; Energy efficient light design of buildings - Daylight design of buildings.

UNIT IV	APPLIANCES IN BUILDINGS AND ENERGY CONSERVATION	9

Major appliances in building and their energy consumptions; Principles of solar heating, cooling and power (PV) systems; Energy rating - Integration of energy efficient appliances with the buildings; concepts of Energy conservation.

UNIT V	ENERGY AUDIT AND GREEN BUILDINGS	9

Energy survey and energy audit of buildings; Calculation of energy inputs and utilization in buildings; Energy audit reports of buildings; Concepts of Green Buildings–ratings of Green buildings; Case studies, LEED ratings, IGBC,GRIHA; Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	determine the Energy consumption pattern of various types of buildings.	Applying (K3)
CO2	describe the environmental factors affecting building design.	Understanding (K2)
CO3	compute the thermal performance of materials used in the building envelope with respect to the climatic conditions.	Applying (K3)

CO4	apply Energy efficient lighting design in the buildings for energy conservation.	Applying (K3)
CO5	explain the various existing ratings of Green buildings and to conduct the Energy auditing of buildings.	Analyzing (K4)

REFERENCES

1. Threlkeld J.L., "Thermal Environmental Engineering", Print ice Hall, Engle woodCliffs,N.J, 2010.
2. Lal Jayamaha,"Energy Efficient Building Systems: Green Strategies for Operation and Maintenance", Mc Graw Hill, 2007.
3. Mili Majumdar, "Energy–Efficient Building in India", Ministry of non–conventional Energy Sources, TERI, Thomson Press India Ltd., New Delhi, 2002.
4. 'Handbook on functional requirements of buildings', Parts1-4,SP:41(S&T)-1987, Bureau of Indian Standards, Manak Bhavan,9 Bahadur Sha Zhfar Marg, NewDelhi, India, BIS-2012.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's					
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CO1	2	-	2	3	2	3
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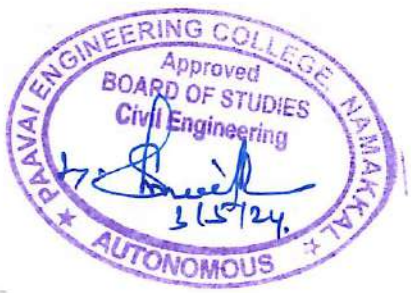
CO3	2	-	2	2	3	3
CO4	1	-	1	3	3	3
CO5	1	-	2	2	2	3



PSE23169	EARTHQUAKE ANALYSIS AND DESIGN OF STRUCTURES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	study the basics of earthquake engineering and how they influence the structural design
2	know about lateral analysis and building characteristics.
3	study the earthquake engineering design, code provision on different types of structures.
4	design the structural modeling and lateral load resisting design.
5	design the brick masonry construction.

UNIT I	ENGINEERING SEISMOLOGY	9

Seismology - Basic Terms, Plate Tectonics, rebound theory, Seismic Waves, Earthquake Magnitude and Intensity, Ground Motion, Dynamic Response of Structures, Normalized Response Spectra, Seismic Coefficients and Seismic zone Coefficients.

UNIT II	LATERAL ANALYSIS OF BUILDING SYSTEMS	9

EQ load on simple buildings - Moment Resisting Frames, Torsion and Rigidity; Rigid Diaphragms- Torsional Moment, Centre of Mass and Centre of Rigidity, Torsional Effects; Lateral Load Distribution with Rigid Floor Diaphragms- Shear Wall, Frame Combination, Examples.

UNIT III	CONCEPT OF EARTHQUAKE RESISTANT DESIGN	9

Objectives of Seismic Design as per IS 1893 - IS 13920 Ductility, Response Modification Factor; Design Spectrum- Classification of Structural System, Seismic Design of Structures, Multi-storeyed buildings, Storey Drift; Design Examples- Ductile Detailing of RCC frames , shear wall.

UNIT IV	SEISMIC DESIGN OF LIQUID STORAGE RESERVOIRS	9

Elevated Liquid Storage tanks - Hydrodynamic Pressure in Tanks.

UNIT V	SEISMIC DESIGN OF BRICK MASONRY CONSTRUCTION	9

Shear Walls and Cross Walls - Opening in Bearing Walls, Brick Infill in Framed Buildings, Strengthening Arrangements as per IS-4326, Design of bands.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	describe the basics of earthquake engineering and how they influence the structural design	Understanding (K2)
CO2	identify about lateral analysis and building characteristics.	Analyzing (K4)
CO3	compute the earthquake engineering design, code provision on different types of structures.	Applying (K3)
CO4	recall the structural modeling and lateral load resisting design.	Remenbering (K1)
CO5	explain the brick masonry construction.	Analyzing (K4)

REFERENCES

1. Bruce A Bolt, "Earthquakes" W H Freeman and Company, New York, 2004.
2. C. A. Brebbia,"Earthquake Resistant Engineering Structures VIII",WIT Press, 2011
3. Mohiuddin Ali Khan "Earthquake-Resistant Structures: Design, Build and Retrofit", Elsevier Science & Technology, 2012
4. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2009

CO-PO MAPPING:

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CO's	PO's					
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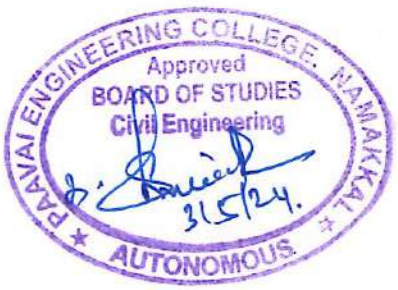
CO1	2	-	3	3	2	2
CO2	1	-	1	2	3	3
CO3	2	-	2	2	3	3
CO4	1	-	1	3	3	3
CO5	3	-	2	2	2	3



PSE23170	WIND AND CYCLONE EFFECTS ON STRUCTURES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	study the concept of wind and cyclone effects for analysis and design of structures
2	know the usage of codal provisions for the wind and cyclone design of structures
3	study the static and dynamic on tall buildings
4	design the special structures based on wind effects
5	analyse the cyclone effects on tall buildings

UNIT I	INTRODUCTION TO WIND	9

Wind -Types of wind, Characteristics of wind; Wind velocity- Method of measurement, variation of speed with height shape factor, aspect ratio; drag and lift effects - Dynamic nature of wind, Pressure and suctions, Spectral studies, Gust factor.

UNIT II	WIND TUNNEL STUDIES	9

Wind tunnel studies - Types of tunnels, modelling requirements, interpretation of results; aero dynamic and aero-elastic models; Prediction of acceleration - Load combination factors; Wind tunnel data analysis, Calculation of Period and damping value for wind design.

UNIT III	WIND EFFECT ON STRUCTURES	9

Classification of structures - Rigid and Flexible, Effect of wind on structures; Vortex shedding translational vibration of structures ; Static and dynamic effects on Tall buildings - Chimneys.

UNIT IV	DESIGN OF SPECIAL STRUCTURES	9

Design of Structures for wind loading - as per IS-875, ASCE and NBC code provisions; design of industrial structures -Tall Buildings, Chimneys ;Transmission towers and steel monopoles - Industrial sheds (Roofs and Shelters).

UNIT V	CYCLONE EFFECTS	9

Cyclone effect on - low rise structures, sloped roof structures, Tall buildings; Effect of cyclone on claddings -design of cladding, use of code provisions in cladding design, Analytical procedure and modelling of cladding.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	compute the high rise structures subjected wind load, even structures exposed to cyclone	Understanding (K2)
CO2	examine the various codal provisions for the design of structures for wind load	Analyzing (K4)
CO3	describe the wind effect on a structure	Applying (K3)
CO4	determine the various types of structure as per IS and NBC codal provision	Remenbering (K1)
CO5	explain various types of cyclone effects	Analyzing (K4)

REFERENCES

1. Wind Effects on Structures: Modern Structural Design for Wind, 2019 by Emil Simiu (Author), DongHun Yeo (Author).
2. Cook.N.J., "The Designer's Guide to Wind Loading of Building Structures", Butterworths,1989
3. Kolousek.V, Pirner.M, Fischer.O and Naprstek.J, "Wind Effects on Civil Engineering Structures", Elsevier Publications, 1984
4. Lawson T.V., "Wind Effects on Building Vol. I and II", Applied Science Publishers, London,1980

CO-PO MAPPING:

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CO's	PO's					
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CO1	2	-	3	2	2	2
CO2	1	-	1	3	3	3
CO3	2	-	2	2	3	3
CO4	1	-	1	3	3	3
CO5	3	-	2	2	2	3

PSE23901	CLIMATE CHANGE AND ADAPTATION	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	realize the Earth's climate system and concept of global warming.
2	know the basics of atmosphere and its components.
3	recognize the impact of climate change on society.
4	study the observed changes and its causes.
5	identify the impact of climate change on society and mitigation measures.

UNIT I EARTH'S CLIMATE SYSTEM **9**

Role of ozone in environment - ozone layer, ozone depleting gases, Green House Effect, Radiative effects of Greenhouse Gases; Hydrological Cycle; Green House Gases and Global Warming - Carbon Cycle.

UNIT II ATMOSPHERE AND ITS COMPONENTS **9**

Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere, Vertical structure of the atmosphere, Composition of the atmosphere, Atmospheric stability, Temperature profile of the atmosphere, Lapse rates, Temperature inversion, effects of inversion on pollution dispersion.

UNIT III IMPACTS OF CLIMATE CHANGE **9**

Causes of Climate change - Change of Temperature in the environment, Melting of ice Pole-sea level rise, Impacts of Climate Change on various sectors, Agriculture; Forestry and Ecosystem - Water Resources, Human Health, Industry; Settlement and Society – Methods and Scenarios, Projected Impacts for Different Regions, Uncertainties in the Projected Impacts of Climate Change, Risk of Irreversible Changes.

UNIT IV OBSERVED CHANGES AND ITS CAUSES **9**

Climate change and Carbon credits – CDM, Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change, Climate Sensitivity and Feedbacks; The Montreal Protocol - UNFCCC, IPCC, Evidences of Changes in Climate and Environment – on a Global Scale and in India

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES **9**

Clean Development Mechanism - Carbon Trading, examples of future Clean Technology; Biodiesel - Natural Compost, Eco-Friendly Plastic; Alternate Energy - Hydrogen, Bio-fuels, Solar Energy, Wind Hydroelectric Power; Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices - Energy Supply, Transport, Buildings, Industry, Agriculture, Forestry; Carbon sequestration - Carbon capture and storage (CCS), Waste (MSW and Bio waste, Biomedical, Industrial waste; International and Regional cooperation

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	Recall the opportunities of predicted climate change will influence specific sectors at global and regional scale.	Remembering (K1)

CO2	describe the physical and chemical characteristics of atmosphere.	understanding (K2)
CO3	evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts.	Analyzing (K4)
CO4	evaluate the scientific insights underlying the assessment reports of the IPCC with a focus on impacts, adaptation and mitigation.	Analyzing (K4)
CO5	develop the need for mitigation and adaptation in environment.	Applying (K3)

REFERENCES

1. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007
2. Adaptation and mitigation of climate Change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
3. J.M. Wallace and P.V. Hobbs, "Atmospheric Science – An Introduction Survey", Elsevier / Academic Press 2006.
4. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

CO-PO MAPPING:

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	1	2	3	4	5	6
CO1	-	-	1	-	-	2
CO2	-	-	1	-	-	2
CO3	-	-	1	-	-	3
CO4	-	-	1	-	-	1
CO5	-	-	1	-	-	2

PSE23901	CLIMATE CHANGE AND ADAPTATION	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	realize the Earth's climate system and concept of global warming.
2	know the basics of atmosphere and its components.
3	recognize the impact of climate change on society.
4	study the observed changes and its causes.
5	identify the impact of climate change on society and mitigation measures.

UNIT I	EARTH'S CLIMATE SYSTEM	9

Role of ozone in environment - ozone layer, ozone depleting gases, Green House Effect, Radiative effects of Greenhouse Gases; Hydrological Cycle; Green House Gases and Global Warming - Carbon Cycle.

UNIT II	ATMOSPHERE AND ITS COMPONENTS	9

Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere, Vertical structure of the atmosphere, Composition of the atmosphere, Atmospheric stability, Temperature profile of the atmosphere, Lapse rates, Temperature inversion, effects of inversion on pollution dispersion.

UNIT III	IMPACTS OF CLIMATE CHANGE	9

Causes of Climate change - Change of Temperature in the environment, Melting of ice Pole-sea level rise, Impacts of Climate Change on various sectors, Agriculture; Forestry and Ecosystem - Water Resources, Human Health, Industry; Settlement and Society – Methods and Scenarios, Projected Impacts for Different Regions, Uncertainties in the Projected Impacts of Climate Change, Risk of Irreversible Changes.

UNIT IV	OBSERVED CHANGES AND ITS CAUSES	9

Climate change and Carbon credits – CDM, Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change, Climate Sensitivity and Feedbacks; The Montreal Protocol - UNFCCC, IPCC, Evidences of Changes in Climate and Environment – on a Global Scale and in India

UNIT V	CLIMATE CHANGE AND MITIGATION MEASURES	9

Clean Development Mechanism - Carbon Trading, examples of future Clean Technology; Biodiesel - Natural Compost, Eco-Friendly Plastic; Alternate Energy - Hydrogen, Bio-fuels, Solar Energy, Wind Hydroelectric Power; Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices - Energy Supply, Transport, Buildings, Industry, Agriculture, Forestry; Carbon sequestration - Carbon capture and storage (CCS), Waste (MSW and Bio waste, Biomedical, Industrial waste; International and Regional cooperation

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	Recall the opportunities of predicted climate change will influence specific sectors at global and regional scale.	Remembering (K1)

CO2	describe the physical and chemical characteristics of atmosphere.	understanding (K2)
CO3	evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts.	Analyzing (K4)
CO4	evaluate the scientific insights underlying the assessment reports of the IPCC with a focus on impacts, adaptation and mitigation.	Analyzing (K4)
CO5	develop the need for mitigation and adaptation in environment.	Applying (K3)

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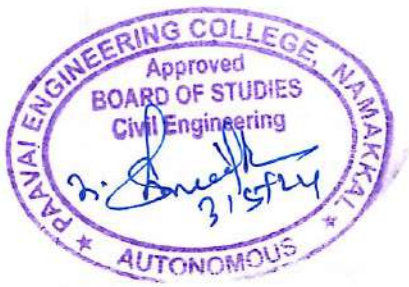
CO4	-	-	1	-	-	1
CO5	-	-	1	-	-	2



PSE23901	CLIMATE CHANGE AND ADAPTATION	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	realize the Earth's climate system and concept of global warming.
2	know the basics of atmosphere and its components.
3	recognize the impact of climate change on society.
4	study the observed changes and its causes.
5	identify the impact of climate change on society and mitigation measures.

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	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	Recall the opportunities of predicted climate change will influence specific sectors at global and regional scale.	Remembering (K1)

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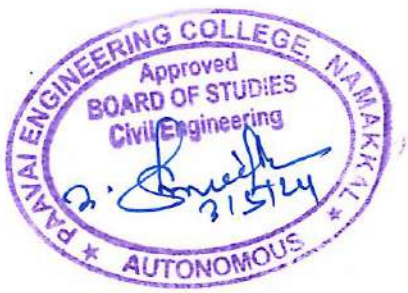
CO4	-	-	1	-	-	1
CO5	-	-	1	-	-	2



PSE23901	CLIMATE CHANGE AND ADAPTATION	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	realize the Earth's climate system and concept of global warming.
2	know the basics of atmosphere and its components.
3	recognize the impact of climate change on society.
4	study the observed changes and its causes.
5	identify the impact of climate change on society and mitigation measures.

UNIT I	EARTH'S CLIMATE SYSTEM	9

Role of ozone in environment - ozone layer, ozone depleting gases, Green House Effect, Radiative effects of Greenhouse Gases; Hydrological Cycle; Green House Gases and Global Warming - Carbon Cycle.

UNIT II	ATMOSPHERE AND ITS COMPONENTS	9

Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere, Vertical structure of the atmosphere, Composition of the atmosphere, Atmospheric stability, Temperature profile of the atmosphere, Lapse rates, Temperature inversion, effects of inversion on pollution dispersion.

UNIT III	IMPACTS OF CLIMATE CHANGE	9

Causes of Climate change - Change of Temperature in the environment, Melting of ice Pole-sea level rise, Impacts of Climate Change on various sectors, Agriculture; Forestry and Ecosystem - Water Resources, Human Health, Industry; Settlement and Society – Methods and Scenarios, Projected Impacts for Different Regions, Uncertainties in the Projected Impacts of Climate Change, Risk of Irreversible Changes.

UNIT IV	OBSERVED CHANGES AND ITS CAUSES	9

Climate change and Carbon credits – CDM, Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change, Climate Sensitivity and Feedbacks; The Montreal Protocol - UNFCCC, IPCC, Evidences of Changes in Climate and Environment – on a Global Scale and in India

UNIT V	CLIMATE CHANGE AND MITIGATION MEASURES	9

Clean Development Mechanism - Carbon Trading, examples of future Clean Technology; Biodiesel - Natural Compost, Eco-Friendly Plastic; Alternate Energy - Hydrogen, Bio-fuels, Solar Energy, Wind Hydroelectric Power; Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices - Energy Supply, Transport, Buildings, Industry, Agriculture, Forestry; Carbon sequestration - Carbon capture and storage (CCS), Waste (MSW and Bio waste, Biomedical, Industrial waste; International and Regional cooperation

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	Recall the opportunities of predicted climate change will influence specific sectors at global and regional scale.	Remembering (K1)

CO2	describe the physical and chemical characteristics of atmosphere.	understanding (K2)
CO3	evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts.	Analyzing (K4)
CO4	evaluate the scientific insights underlying the assessment reports of the IPCC with a focus on impacts, adaptation and mitigation.	Analyzing (K4)
CO5	develop the need for mitigation and adaptation in environment.	Applying (K3)

REFERENCES

1. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007
2. Adaptation and mitigation of climate Change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
3. J.M. Wallace and P.V. Hobbs, "Atmospheric Science – An Introduction Survey", Elsevier / Academic Press 2006.
4. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's					
	1	2	3	4	5	6
CO1	-	-	1	-	-	2
CO2	-	-	1	-	-	2
CO3	-	-	1	-	-	3
CO4	-	-	1	-	-	1
CO5	-	-	1	-	-	2