7th Semester

Code	Subject	Hours/ Week			Marks		Duration of End Semester examination	Credits
		L	T	P/ D	Internal	End Semester		
CE14 701	Structural Design III	3	1	0	50	100	3	4
CE14 702	Design of Hydraulic Structures	2	0	2	50	100	3	4
CE14 703	Environmental Engineering I	3	1	0	50	100	3	4
CE14 704	Elective I	3	1	0	50	100	3	4
CE14 705	Elective II	3	1	0	50	100	3	4
CE14 706 (P)	Computer Applications Lab	0	0	3	50	100	3	2
CE14 707 (P)	Environmental Engineering Lab	0	0	3	50	100	3	2
CE14 708 (P)	Project	0	0	4	100	-		4
	TOTAL	14	4	12				28

Elective I

CE14 704(A) Advanced Structural Design I
CE14 704(B) Advanced Geotechnical Engineering I
CE14 704(C) Highway Pavement Design

CE14 704(D) Experimental Stress Analysis (G)
CE14 704(E) Concrete Technology

Elective II

CE14 705(A) Structural Dynamics & Seismic Design
CE14 705(B) Soil Exploration, Testing and Evaluation
CE14 705(C) Ecology and Environmental Chemistry
CE14 705(D) Ground Water Hydrology
CE13 705(E) Finite Element Methods (G)

7th Semester

CE14 701: Structural Design III

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- To provide knowledge in the structural Design of selected advanced structures of concrete and steel

Part A: Reinforced Concrete
Module I (16 hours)
Design of columns subjected to axial load, uni-axial and bi-axial eccentrically loaded short and slender columns using SP 16 of BIS by limit state method.
Different types of foundations-Design of isolated footing for axially loaded & eccentrically loaded columns, combined footing.

Module II (12 hours)
Design of cantilever and counter fort retaining walls
Design of R.C.C. Slab Bridge for IRC loading –Detailing
Design of rectangular and circular water tanks using IS code coefficients (IS 3370).
Design of spherical and conical domes-detailing

Module III (11 hours)
Prestressed Concrete fundamentals -Materials, principles – methods of prestressing- pre and post tensioning -losses of prestress. Analysis of stresses in pre and post tensioned beams (rectangular and I sections) at stages of transfer and service-cable profiles (principles only), concept of Type I, II and III PSC structures as per IS. Stresses in anchorage zone in post-tensioned beams (description only; no design expected)

Part B: Steel & Timber
Module IV (13 hours)
Design of plate girders-design of section for flexure, shear and deflection-connections-horizontal and vertical stiffeners-curtailment of flange plates - design of bearing stiffener, web splices. Plate girder Railway Bridges- Types, structural configurations, Assessment of loads and stresses, design principles of bridge bearings.
Design of timber beam and column.

Note:
All designs shall be done as per current I.S. code specifications and practice
Special importance shall be given to detailing in designs
S.I. units shall be followed
Limit state design shall be practiced wherever possible as per codes
Use of IS 3370 (1 to 4), IRC 21(1, 2, 3, 7, 9), IS 13743, IS 800, IS 875 and SP 6 and SP16 shall be permitted in the examination hall.

Text Books:
1. Pillai S.U. & Menon D., Reinforced Concrete Design. Tata McGraw Hill
2. Punmia .B.C., Jain A. K., Reinforced Concrete Structures, Lexmi Publications
3. Johnson D. Victor, Essentials of Bridge Engineering, Oxford & IBH

4. Krishnaraju, Prestressed Concrete, Tata McGraw Hill
5. Subramanian N, Design of steel Structures, Oxford University Press
6. Ram Chandra., Design of steel Structures, Standard Book House
7. Jagadeesh & Jayaram: Design of Bridg structures, Printice Hall of India
8. Punmia .B.C., Jain A. K., Design of Steel Structures, Lexmi Publications

Reference Books:

1. Park & Paulay, Reinforced Concrete, McGraw Hill
2. Varghese P.C., Limit State Design of Reinforced Concrete, Prentice Hall of India
3. Varghese P.C., Advanced Reinforced Concrete Design, Prentice Hall of India
4. Mallick S.K, and Gupta A.K., Reinforced Concrete. Oxford & IBH
5. Jain. A.K., Reinforced Concrete-Limit state Design, Standard Book House
6. Jain and Jaikrishna, Plain and Reinforced Concrete Vol I & II, Nemchand
7. Winter and Nelson, Design of concrete Structures.. Tata McGraw Hill
8. Lin. T.Y. and Burns, Design of Prestressed Concrete Structures., John Wiley
10. Libby J., Prestressed concrete structures, CBS Publishers
11. Krishnaraju N., Sructural Design and Detailing, Reinforced concrete and steel, University Press
12. Gaylord and Stallmeyer, Steel structures, McGraw Hill
13. Sinha,N.C., Sujit Kumar Roy, Fundamentals of Prestressed concrete, S Chand

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 702: Design of Hydraulic Structures

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour drawing per week

Objective:

- Students are expected to know the details of major and minor irrigation structures and their design. A student, who successfully completes the course, should be able to carry out design of various hydraulic structures in the given field conditions. Also to make the students familiarize with the relevant I.S codes and to enhance the capability of reading the working drawings.

Module I (13 hours*)
Storage Head Works;
Types of dams - gravity dam - selection of site - forces acting on dams - drainage gallery - joints in dams - elementary profile - limiting height of gravity dam - high and low dam - practical profile of a high gravity dam- design methods and design by gravity analysis only- arch dam – design methods – design by cylinder theory only. spillways and their types

Module II (13 hours*)
Tank structures
Surplus works – types of surplus works- surplus weir –surplus escapes, core wall type – flush escape
Outlet works - tank sluice with tower head
Canal structures
Canal outlets-review of requirements and types-modular, semi modular, non-modular outlets- design of direct sluice
(Detailed design and drawing of surplus weir, tank sluice and direct sluice are expected)

Module III (13 hours*)
Diversion head works- Types – design of surface and subsurface weirs - design of regulator cum Road Bridge
Canal falls- design of trapezoidal notch canal fall - design of syphon well drop-
(Detailed designs and drawings of canal regulator cum road bridge, trapezoidal notch fall and siphon well drop are expected.)

Module IV (13 hours*)
Cross drainage works - necessity - types of cross drainage works - selection of suitable type of cross drainage works - types of aqueducts- design of aqueduct - syphon aqueduct (type II and III) super passage and canal syphon
(Detailed designs and drawings of aqueduct and syphon aqueduct (Type II) are expected).
* Hours are inclusive of drawing classes.

Text books:

1. Asawa, Irrigation Engineering, Wiley Eastern Publication

2. Sathyanarayana Murthy, Water Resources Engineering, Wiley Eastern

3. S. K Garg, Irrigation Engineering and Hydraulics, Khanna Publishers

Reference books:

1. Varshney R.S., Theory & Design of Irrig. Structures, Nem Chand
2. Punmia B.C., Irrigation & Waterpower Engg., Laxmi Publications

3. Serge Liliavsky, Irrigation & Hydraulic Design, Chapman and Hall
4. IS: 6512 (1984) – Criteria for design of storage gravity dams
5. IS 7784 (Part I (1993), Part II Section 1 to 5 (1995)) Design of cross drainage works – Code of Practice
6. IS: 6966 Part I (1989) – Hydraulic design of barrages and weirs – Guidelines
7. IS: 11130 (1984) – Criteria for structural design of barrages and weirs
8. IS:6531 (1972) – Criteria for design of canal head regulator
9. IS:7114(1973) – Criteria for hydraulic design of cross regulator for canal
10. IS:6936 (1992) – *Guide for location ,selection and hydraulic design of canal escapes*
11. IS:12331 – *General requirement of canal outlets*

Internal Continuous Assessment *(Maximum Marks-50)*

Tests (minimum 2) – 22 Marks
Assignments (8 Drawing Sheets) – 24 Marks
Regularity in the class – 4 Marks
Note: Since drawing shall be given more importance in this subject apportioning of marks are kept different.

University Examination pattern
PART A: *Questions for Short answers* *4×5 marks=20 Marks*
Candidates have to answer four questions out of five. There should be at least one question from each module and not more than two questions from any module.
PART B: *1×15 marks=15 Marks*
Candidates have to answer one question out of two. Both questions shall be from module I.
PART C: questions for presenting *Design and drawing* *1×65 marks= 65 Marks*
Two questions from any module other than Module I, with choice to answer one question. Both the questions shall be from two different modules.
Maximum Total marks: 100

CE 14 703 Environmental Engineering I

Teaching scheme **Credits: 4**
3 hours lecture and 1 hour tutorial per week

Objective:
- To provide detailed understanding regarding usage of water for drinking purpose - from identification of source, planning the treatment systems, distribution of treated water with development of distribution of layout and necessity of maintenance.

Module I (10 hours)
Water supply Engineering – Importance and necessity of community water supply schemes – essentials of water supply engineering – quantity of water – forecasting population – rate of consumption for various purposes – factors affecting consumption – fluctuations in demand.

Module II (14 hours)
Sources of water – surface water sources – suitability of the source with respect to quantity and quality – intakes of various surface water sources – design of intakes – ground water sources -

development and protection of groundwater sources – estimation of yield from various ground water sources – construction of tube wells – maintenance.
Quality of water – drinking water standards – physical, chemical and bacteriological analysis of water.

Module III (14 hours)
Treatment of water – aeration – coagulation – flocculation – sedimentation – filtration – disinfection – design of all the units – miscellaneous treatments – removal of colour, taste and odor, iron and manganese, hardness – fluoridation and deflouridation.

Module IV (14 hours)
Water supply schemes – gravitational, pumping and combined schemes – transmission of water – classification of conduits – shape and strength of conduits – location of conduits – materials of conduits – design of gravity and pumping main - distribution systems – different layout of pipe networks – analysis of pipe networks – house connection from mains – laying and joining of pipes – appurtenances – different valves – meters and hydrants – detection and prevention of leaks in distribution system – cleaning and maintenance of distribution system.

Text Books:

1. Garg S. K., *Environmental Engineering Vol I*, Khanna Publishers.
2. Birdie G.S & Birdie J.S, *Water Supply and Sanitary Engineering*, Dhanpat Rai & Sons.
3. Duggal K N, *Elements of Environmental Engineering*, S Chand & Co Ltd.

Reference Books:

1. Mark J Hammer Mark J Hammer Jr., *Water and Waste Water Technology*, Prentice Hall of India Pvt. Ltd.
2. Fair, Gayer and Okun, *Water and Waste water Engineering*, John Wiley.
3. Ernest W Steel, *Water Supply and sewerage*, McGraw Hill.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 706 (P): Computer Applications Laboratory

Teaching scheme **Credits : 2**

3 hours practical per week (Minimum 39 hrs)

Objective:

To familiarize and give hands-on training to students in the following areas of civil engineering application software:

1. **Surveying** - Terrain mapping, computation of areas and volumes – Estimation of earth work, GIS
2. **Structural Engineering –** Analysis and design of Plane and space frames (steel and R.C.C), spread sheet development for design of R.C.C/ steel structural elements.
3. **Water resources** –Circular Pipe Analysis / Trapezoidal Channel Analysis, analysis of pipe network for water distribution
4. **Geotechnical engineering** –stability analysis of slopes, computation of foundation settlement and stresses on layered soils, Geotechnical design of anchored and free retaining walls, Analysis and design of pile foundations.
5. **Road/railway system –** Fixation of vertical / horizontal alignment of highways, Design of rigid and flexible pavements.
6. **Environmental engineering**- Pipe Network Analysis
7. **Estimation and costing** - Use spread sheet / any standard software for estimation.
8. **Project management –** PERT and CPM**,** project scheduling, managing and documentation, Network Analysis.

Notes:

1. **Students are supposed to document each tutorial with drafting after each session.**
2. **At least five of the above eight areas shall be covered.**

Recommended software packages: The following packages or their equivalent are recommended for the above listed exercises:

- AutoCAD, Microstation, MS-Office, Matlab, Grapher/Sigmaplot
- Autocivil, SAP, StAAD, ANSYS, NISA, GTSTRUDL
- WaterCAD, FlowMaster, EPA NET, Geo4, Inroads, ArcGIS
- MS-Project

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Note: Students shall be encouraged to take up a term-project on any of the above listed areas and complete it within the semester

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

CE 14 707(P): Environmental Engineering Laboratory

Teaching scheme **Credits: 2**
3 hours practical per week (Minimum 39 hrs)

Objective

- To make students familiar with laboratory tests for water quality assessment.

List of Experiments

1. Determination of Solids (Total, dissolved and suspended) in water.
2. Determination of Turbidity of water and estimation of optimum coagulant dosage by jar test.
3. Determination of alkalinity of water.
4. Determination of hardness of water by EDTA titrimetric method.
5. Determination of chlorides in water.
6. Determination of iron and manganese in water
7. Determination of sulphates and sulphides in water.
8. Determination of dissolved oxygen in water.
9. Determination of available chlorine in bleaching powder and test for residual chlorine.
10. Determination of pH of water (by various methods).
11. Determination of B.O.D and C.O.D of wastewater sample.
12. Determination of MPN (demonstration only)

Reference Books:

1. Standard methods for the examination of water and wastewater, 1995, ALPHA, AWWA, WPCF Publication.
2. Sawyer and Mc Carty, Chemistry for Environmental Engineering, McGraw Hill.
3. P.R. Sreemahadevan Pillai, Comprehensive Laboratory Manual for Environmental Science and Engineering, 2009, New Age International Pvt. Ltd. Publishers, New Delhi.

Internal Continuous Assessment *(Maximum Marks-50)* 60%-Laboratory practical and record 30%- Test/s 10%- Regularity in the class **Note:** Students shall be made aware of Computer integrated test methods for water quality assessment.
End Semester Examination *(Maximum Marks-100)* 70% - Procedure, conducting experiment, results, tabulation, and inference 20% - Viva voce 10% - Fair record

CE 14 708 (P): Project

Teaching scheme **Credits: 4**
4 hour per week

Objective

- ***To develop the capacity of the students in converting the theoretical knowledge into practical systems either to perform creative works or to perform analysis and hence to suggest solutions to problems, pertaining to Civil Engineering domain.***

Project work is of duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project work can be a planning and / or design project, experimental project, computer application based project on any of the topics of civil engineering interest. HOD will frame the rules for forming batches. If required, HOD can combine project hours of many weeks together and allot a maximum of 2 weeks exclusively for project. The project batches are expected to fix their topics, complete preliminary studies like literature survey, field measurements, data collection, etc. in the seventh semester. Also they are expected to finish about 40% of their work in 7^{th} semester.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee consisting of guide and three or four faculty members specialised in various fields of civil engineering, shall study the feasibility of each project work before giving consent.

As far as possible, students should execute the project work using the facilities of the institute. However, external projects can be taken up in government departments/institutions, reputed construction industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

The assessment of all the projects should be done at the end of the seventh semester by the project evaluation committee formed as mentioned earlier. The students will present their project details and progress of their project to the committee. The complete project report is not expected at the end of the seventh semester. However, a typed interim report based on the work done should be submitted by each student batch to the assessing committee. The assessment committee and project guides will award the marks for the individual students in a project as follows:

50% of the marks is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment:
20% - Technical relevance of the project
40% - Literature survey and data collection
20% - Progress of the project and presentation
10% - Report
10% - Regularity in the class

ELECTIVES

CE 14 704 (A): Advanced Structural Design I

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:

- To equip the students to assess the loads on some important types of structures, choose the method of appropriate analysis according to the situation and perform design

Module-1 (13 Hours)
Design of Deep beams & Corbels
Design of Ribbed Slabs
Yield line theory of slabs – Design of Square, Rectangular & Circular slabs for UDL and point load at centre

Module –II (13 Hours)
Design of flat slabs by direct design method and equivalent frame method as per IS 456-2000.
Design of multi-bay multi storied portal frames for gravity loads, Pattern loading - Use of SP 16 (Substitute Frame method of analysis may be followed)

Module III (13 Hours)
Design of Light Gauge members – compression and flexural members
Design of Self Supporting & Guyed steel Chimney (design for wind dynamics not expected)

Module – IV (13 Hours)
Basic principles of analysis of Base-excited SDOF and MDOF systems - formulation of basic equation– concepts of pseudo acceleration, velocity and displacement - Earthquake response spectra (concept only) .
Lumped mass modelling of multi-storey shear building and modes of vibration (concepts only- demonstration with example- students are not expected to solve numerical problem on evaluation of modes during examination)-modes superposition- SRSS and CQC (Introduction only)-Concept of design spectrum for earthquake- use of IS 1893.

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE 14 704 (C) Highway Pavement Design

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

To equip the students to carry out design and evaluation of flexible and rigid pavements in varied field conditions.

Note: IRC 37 2001 and 58-2002 and design charts are permitted for University Examinations

Module I (12 hours)

Introduction: types and component parts of pavements - factors affecting design and performance of pavements - comparison between highway and airport pavements - functions and significance of sub grade properties – various methods of assessment of sub grade soil strength for pavement design - cause and effects of variations in moisture content and temperature - depth of frost penetration - design of bituminous mixes by Marshall method

Module II (14 hours)

Stress analyses and methods of flexible pavement design: stresses and deflections in homogeneous masses - burmister 2 layer and 3 layer theories - wheel load stresses - ESWL of multiple wheels - repeated loads and EWL factors - empirical, semi - empirical and theoretical approaches for flexible pavement design - group index, CBR, triaxial, mcleod and burmister layered system methods

Module III (14 hours)

Stresses analysis and methods of rigid pavement design: types of stresses and causes - factors influencing
stresses, general conditions in rigid pavement analysis - ESWL- wheel load stresses - warping stresses – friction stresses - combined stresses - functions of various types of joints in cement concrete pavements - design and detailing of slab thickness ; longitudinal, contraction and expansion joints by IRC recommendations

Module IV (12 hours)

Pavement evaluation: structural and functional requirements of flexible and rigid pavements - pavement distress - evaluation of pavement structural condition by Benkelman beam rebound deflection and plate load tests - introduction to design of pavement overlays
Problems of highway rehabilitation – pavement rehabilitation programming.

Text Book:
Khanna S.K. and Justo, CEG, *Highway Engineering*, NemChand and bros.

References:
1. Yoder and W Nitezak, *'Principles of Pavement Design'*, John Wiley
2. Yang, *'Design of Functional Pavements'*, McGraw Hill
3. IRC: 37 - 2001, *'Guidelines for the Design of Flexible Pavements'*
4. IRC: 58 - 2002, *'Guidelines for the Design of Rigid Pavements'*
5. David Croney, *'The Design and Performance of Road pavements'*, HMSO publications
6. Hass and Hudson, *'Pavement Management System*', McGraw Hill Book Co.
7. IRC 81-1981- '*Tentative Guidelines for Strengthening of Flexible Pavements by Benklman Beam Deflections Techniques'.*

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 704 (D): Experimental Stress Analysis

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective
To make students aware of various measurement techniques and experimental planning and procedures adopted in laboratory

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE14 704 (E) Concrete Technology

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

To understand in detail the behaviour of fresh and hardened concrete.
To aware recent developments in concrete technology
To understand factors affecting the strength, workability and durability of concrete

Module I (13 hrs)

Cements: Review of cements including blended cements, chemical composition; tests on chemical and physical properties; process of hydration.

Aggregates: Review of types; production of artificial aggregates; sampling and testing; effects on properties of concrete; special aggregates.

Chemical Admixtures: Review of types and classification; actions and interactions; usage; effects on properties of concrete; methods of test; applications.

Mineral Admixtures: Flyash, ground granulated blast furnace slag, metakaolin, rice-husk ash and silica fume; chemical composition; physical characteristics; effects on properties of concrete; methods of test; applications advantages and disadvantages

Module II (13 hrs)

Special concrete: Lightweight concrete; autoclaved aerated concrete; no-fines concrete; lightweight aggregate concrete and foamed concrete.

High strength concrete; refractory concrete; high density and radiation-shielding concrete;

Polymer concrete; fibre reinforced concrete; Ferro-cement; recycled aggregate concrete; Prepacked concrete.

High-performance concrete, Self compacting concrete, Pumpable concrete, Ready mixed concrete

Module III (13 hrs)

Non-destructive testing of concrete-Surface Hardness, Ultrasonic, Penetration resistance, Pull-out, pull-off and break-off methods, Chemical testing for chloride and carbonation- core cutting - measuring reinforcement cover.

Mix Design : Factors considered in the design of mix design of low and medium strength mixes. BIS Method, Introduction to ACI, FM, Road Note No.4 Methods, Mix design of High strength, High density concrete, Light weight concrete and Ready mix concrete

Module IV (13 hrs)

Elasticity, creep and shrinkage- Elastic properties of aggregates- Modulus of elasticity and strength, dynamic modulus of elasticity, Creep- Measurement of creep, factors affecting creep, effect of creep, shrinkage- Plastic shrinkage, drying shrinkage, factors affecting shrinkage, autogeneous shrinkage, carbonation shrinkage

Durability of concrete- Strength and durability relationship, volume change in concrete, permeability, interaction between, permeability, volume change and cracking

Text *books:*

1. Neville A.M.,'Properties of Concrete', Prentice Hall.
2. R. Santhakumar ' Concrete Technology', Oxford Universities Press.
3. Shetty M.S., 'Concrete Technology', S.Chand &Co.
4. Neville A. M. and Brooks J. J., Concrete Technology, Pearson Education.

References:

1. Mehta and Monteiro, 'Concrete-Micro structure, Properties and Materials', McGraw Hill Professional
2. John Newman and Ban Seng Choo , 'Advanced Concrete Technology', Butterworth-Heinemann Ltd.
3.. Satish Chandra ,'Waste materials used for concrete manufacturing', William Andrew Publishing
4.. Malhotra and Ramezanianpour , 'Fly ash in Concrete', Kluwer Academic Publishers
5 . Lea, 'Chemistry of Cement and Concrete', Butterworth-Heinemann Ltd.
6. Aitcin , 'High performance concrete' , E & FPON, NewYork .
7. Bungey, Millard, Grantham – The Testing of Concrete in Structures- Taylor and Francis
8. IRC Highway Research Board – State of the Art: Non-Destructive Testing Techniques of Concrete

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 705 (A): Structural Dynamics and Seismic Design

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective:

To equip students with the basic knowledge on design of earthquake resistant structures