UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

VI SEMESTER

CIVIL ENGINEERING

SCHEME -2013

VI SEMESTER
CIVIL ENGINEERING (C)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/ P				
13.601	Design of Hydraulic Structures (C)	5	3	-	2	50	4	100	150
13.602	Design of Reinforced Concrete Structures (C)	5	3	2	-	50	3	100	150
13.603	Environmental Engineering II (C)	4	3	1	-	50	3	100	150
13.604	Geotechnical Engineering II (C)	4	3	1	-	50	3	100	150
13.605	Transportation Engineering II (C)	4	3	1	-	50	3	100	150
13.606	Computer Programming and Numerical Methods (C)	3	3	-	-	50	3	100	150
13.607	Transportation Engineering Lab.(C)	2	-	-	2	50	3	100	150
13.608	Computer Aided Design & Drafting Lab. (C)	2	-	-	2	50	3	100	150
	Total	**29**	**18**	**5**	**6**	**400**		**800**	**1200**

13.601 DESIGN OF HYDRAULIC STRUCTURES (C)

Teaching Scheme: 3(L) - 0(T) - 2(P) **Credits**: 5

Course Objectives:

- *To impart knowledge regarding the design of the various irrigation structures.*
- *To give an idea of causes of failure, design criteria and stability analysis of different types of dams.*

Module – I

Dams-Gravity dams, arch dams, buttress dam, forces acting on dam-theoretical and practical profiles of gravity dam-low dam, high dam-stability of dam-stress in elementary profile of gravity dam. Function of shafts, galleries, keys and water seal. Arch dams-types, forces acting-design methods (Thin cylinder theory only)-Earth dam-Types-criteria for safe design-causes of failure. Spillways-Different types (Design not necessary).

Module – II

Diversion head works, layout, functions of components- causes of failure of weirs on permeable soils- Bligh's theory-design of vertical drop weir-Khosla's theory of independent variables-use of Khosla's charts and Blench curves. Cross drainage works-different types-Canal falls-classification (brief description only).

Module – III

Design and drawing emphasizing the hydraulic aspects of the following structures:

1. Aqueduct
2. Syphon aqueduct
3. Canal Syphon-Design of Transition by water surface profile computation
4. Notch type canal fall
5. Sarda type fall- High discharge only –Design of floor by Khosla's theory
6. Cross regulator (Khosla's theory).

References:

1. Garg S.K., *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers, Delhi, 2006.
2. Modi P.N. *Irrigation, Water Resources and Water Power Engineering*, S.B.H Publishers and Distributors, New Delhi, 2008.
3. Priyani, V.B, *Fundamental Principles of Irrigation Engineering*. Charotar Books, Anand, India, 1967.

4. Punmia B. C., Asok K. Jain, Arun K. Jain and B. B. L. Pande, *Irrigation and Water Power Engineering*, Laxmi Publications (P) Ltd., 2015.
5. Reghunath H.M., *Irrigation Engineering*, Wiley India Pvt. Ltd., 2011.
6. Satyanarayana M. C., *Water Resources Engineering-Principles and Practice,* New Age International Publishers, 2014.
7. Varshney, R.S *Theory & Design of Irrigation Structures - Vol III*, Nem Chand & Bros., Roorkee, 1982.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, drawings, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 4 hours *Maximum Total Marks: 100*

The question paper shall consist of 3 parts.

Part A (20 marks) - From Module I and Module II. Five Short answer questions of 4 marks each. There should be at least two question from each module and not more than three questions from any module. All questions are compulsory.

Part B (20 Marks) - Candidates have to answer one full question out of the two each from Module I and II. Each question carries 10 marks.

Part C (60 Marks) - Candidates have to answer one full question out of the two from Module III. Each question carries 60 marks. The question consists of design and drawing part. In the drawing part, the questions shall be to draw maximum two views.

Note: *Use of Khosla's chart, Blench curves and Montague curves are permitted in examination halls.*

Course Outcome:

After successful completion of this course, the students will be able to

- *Perform the stability analysis of gravity dams*
- *Explain the causes of failure of different types of dams and their design criteria*
- *Design minor irrigation structures and prepare the detailed drawings of the same.*

13.602 DESIGN OF REINFORCED CONCRETE STRUCTURES (C)

Teaching Scheme: 3(L) - 2(T) - 0(P) **Credits**: 5

Course Objectives:

- *To introduce the various design philosophies.*
- *To impart knowledge about the fundamentals of analysis and design of RCC members.*
- *To develop fundamental knowledge in Pre stress concrete*

Module – I

Introduction to different design philosophies. Principles of Working Stress and Limit State methods (Limit State method in detail), Analysis and Design of singly and doubly reinforced beams of rectangular, and flanged sections for bending and shear.

Module – II

Design of beams for torsion. Limit State of Serviceability –Check for Deflections –cracking (Brief description only). Design of slab spanning in one direction and two directions. Design of continuous beams. Staircases – Design of straight flight and dog-legged staircases.

Module – III

Columns-Interactions curves- Design of short columns with axial loads, uniaxial moment and biaxial moments- Use of SP–16 Charts- Design of long column (Brief description only). Footings- Design of Isolated footings- axial and eccentric loading- Design of Combined footings- rectangular and trapezoidal footings.

Module – IV

Pre-stressed Concrete – General principles- systems of pre stressing- Losses in Pre stress. Analysis of pre stressed beams of rectangular and symmetrical I sections, slabs.

References:

1. Varghese P.C., *Limit State Design of Reinforced Concrete*, Prentice Hall of India Ltd., 2015.
2. Krishnaraju N., *Structural Design and Drawing - Reinforced Concrete and Steel*, Universities Press Ltd., 2009.
3. Jain A. K., *Reinforced Concrete Limit State Design*, Nem Chand Brothers, Roorkee, 2012.
4. Unnikrishna Pillai and Devdas Menon, *Reinforced Concrete Design*, Tata McGraw-Hill, 2010.
5. Sinha S. N., *Reinforced Concrete Design* Tata McGraw Hill, 2002.
6. Krishnaraju N., *Prestressed Concrete*, Tata McGraw Hill, 2007.
7. Mehra H. and V. N. Vazirani, *Limit State Design*, Khanna Publishers, 2007.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Use of IS 456, IS 1343and Interaction curves for columns are permitted in examination halls.

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

The students after undergoing this course will have

- *Capability to design structural members using relevant IS codes and SP16.*
- *Ability to analyse the strength of structural elements.*
- *Ability to analyse the Pre stress concrete symmetrical sections using relevant IS Codes.*

13.603 ENVIRONMENTAL ENGINEERING – II (C)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To impart basic knowledge about the types of impurities in waste water and its quantification, sewer design and sewer appurtenances*
- *To convey the theory of self purification of water bodies and develop an idea of theoretical calculations related to dilution method of waste water disposal*
- *To communicate the importance of waste water treatment and the design procedure of various waste water treatment units*
- *To convey the information about the treatment/disposal techniques of sludge and the introductory knowledge on house drainage and plumbing systems.*

Module – I

Waste water- Sources, Quantity-Characteristics- systems of Sewerage, Types of sewers-Design of circular sewers Sewer appurtenances-Man holes, Catch basin, flushing devices, Inverted siphon, Grease and oil traps.

Module – II

Waste water disposal systems-Natural and Artificial methods-Self purification of streams, Dilution techniques-Oxygen sag curve-Streeter Phelp's Equation and its application- Waste water disposal by land treatment.

Unit operations and processes for Waste water treatment- Treatment of sewage-Preliminary-Theory and design of Screen and Grit chamber, Detritus chamber, Skimming tank.

Module – III

Primary treatment-Sedimentation tank, Secondary treatment-Contact bed, Intermittent sand filter, Trickling filter, Activated sludge process, Design of Trickling filter (High rate, standard), Septic tank and its effluent disposal - Imhoff tank.

Module – IV

Sludge treatment and disposal-Methods of thickening, sludge digestion-High rate, two stage digestion- factors affecting digestion, Disposal of sludge- Sludge drying beds, Lagooning-Dumping, burial. Design of sludge digestion tank, oxidation pond. -Principles of house drainage-System of plumbing.

References

1. Garg S. K., *Sewage disposal and Air pollution Engineering*, Khanna Publishers, 2012.

2. Metcalf L. and H. P. Eddy, *Waste Water Engineering*, Tata McGraw Hill, 1984.
3. Punmia B. C., *Water Supply Engineering*, Laxmi Publications, 1995.
4. Modi P. N., *Sewage Treatment & Disposal and Waste water Engineering*, New Delhi, 1970.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

After successful completion of the course, the students will be able to:

- *Explain the methods of analysis of waste water and the basic features of different sewer appurtenances.*
- *Understand the main issues related to water pollution and analyse/explain self purification in water bodies.*
- *Explain and design various units of a typical waste water treatment plant.*
- *Develop the procedures for treatment of sludge generated in a waste water treatment plant.*

13.604 GEOTECHNICAL ENGINEERING – II (C)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To impart to the students, in-depth knowledge about the basic concepts and theories in foundation engineering*
- *To enable the students to acquire proper knowledge about various methods of foundation analysis for different practical situations.*

Module – I

Bearing capacity of shallow foundations – Ultimate, safe and allowable bearing capacity. Failure mechanism, assumptions and equation of Terzaghi's bearing capacity theory for strip footing [no derivation required] – Terzaghi's formulae for circular and square footings - Bearing capacity factors - Local and general shear failure - I.S. Code formula - Factors affecting bearing capacity – Influence of water table. Total and differential settlement - Causes - Methods of reducing differential settlement – Brief discussion on soil improvement through installation of vertical drains and preloading, compaction piles and reinforced earth technique.

Module – II

Combined footings- Rectangular and Trapezoidal combined footings – Raft foundations - Allowable Bearing capacity of Rafts on sands and clays - Floating foundation. Lateral earth pressure – At-rest, active and passive earth pressures – Practical examples - Rankine's and Coulomb' theories[no derivation required] – Comparison - Influence of surcharge, inclined backfill and water table on earth pressure - Earth pressure on retaining walls with layered backfill.

Module – III

Stresses in soil due to loaded areas - Boussinesq's and Westergaard's formulae for point loads – assumptions [no derivation required] – Comments - Vertical stress beneath loaded areas of strip, rectangular and circular shapes - Newmark's chart - Isobars- Pressure bulbs. Brief introduction to site investigation –Objectives - Guidelines for choosing spacing and depth of borings [brief discussion only] - Auger boring and wash boring methods - Standard Penetration Test – procedure, corrections and correlations.

Module – IV

Pile foundations - Point bearing and friction piles - Bearing capacity of single pile in clay and sand[I.S. Static formulae] - Dynamic formulae(Modified Hiley formulae only) - I.S. Pile load test [conventional]- Negative skin friction - Group action -Group efficiency - Capacity of Pile groups. Elements of a well foundation – Problems encountered in well sinking – Methods to

rectify tilts and shifts - Brief introduction to Machine foundation –Mass spring model for undamped free vibrations - Natural frequency – Coefficient of uniform elastic compression – Methods of vibration isolation.

References:

1. Ranjan G. and A. S. R. Rao, *Basic and Applied Soil Mechanics*, New Age International, 2002.
2. Arora K. R., *Geotechnical Engineering*, Standard Publishers, 2006.
3. Braja M. Das, *Textbook of Geotechnical Engineering*, Cengage Learning India Pvt. Ltd., Delhi, 2009.
4. Venkataramaiah, *Geotechnical Engineering*, Universities Press, 2000.
5. Peck R. B, Hanzen and Thornborn, *Foundation Engineering*, John Wiley, 1947.
6. Taylor D.W., *Fundamentals of Soil Mechanics*, Asia Publishing House, 1948.
7. Teng W.E., *Foundation Design*, Prentice Hall, New Jersey, 1962.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note:** Use of Tables showing bearing capacity factors, shape factors, depth factors and inclination factors as per I.S. 6403-1981, and Terzaghi' bearing capacity factors are permitted in the Examination hall. Any other relevant data, if necessary, shall be given along with the question paper by the question paper setter.*

Course Outcome:

After successful completion of the course, the students will be able to:

- *understand the basic concepts, theories and methods of analysis in foundation engineering.*
- *assess field problems related to geotechnical engineering and take appropriate decisions.*

13.605 TRANSPORTATION ENGINEERING - II (C)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

To give the students a basic understanding of the various geometric design elements of highways, highway materials, their test procedures and specifications, design and construction of roads, planning and design of various features of Airport.

HIGHWAY ENGINEERING

Module – I

Introduction-Historical Development of Roads-Development of Roads in India, Classification of roads. Highway Alignment: Requirements of highway alignment-factors controlling alignment. Engineering surveys for highway location, preparation of project reports, Highway aesthetics. Highway materials- Desirable properties of aggregates and bitumen-Tests on aggregate and bitumen.

Module – II

Classification of transport technologies-inter modal co-ordination - ITS and automated highways.

Highway drainage- Importance, surface and sub surface drainage systems. Geometric Design: Design controls and criteria, design speed, camber, sight distance, super elevation, widening of pavements on curves, horizontal curves, transition curve, gradient- vertical curves.

Module – III

Pavement Design- types of pavement structures, Design of flexible pavements IRC method. Westergaard's analysis of wheel load stresses and temperature stresses in rigid pavements.

Construction- WBM, Bituminous concrete and cement concrete roads. Failures in flexible and rigid pavements- cause of failures- Maintenance of bituminous and cement concrete pavements.

AIRPORTS

Module – IV

Planning and Design of Airports- Aircraft characteristics which affect planning and design of airports- Airport site selection. Runway Design- Orientation, Wind rose diagram-Basic runway length computation, correction due to elevation, Temperature and gradient, runway geometric design features, Taxiway design requirements, Terminal building, facilities required in a terminal building. Apron: Size and gate positions-parking configurations, parking system.

Typical airport layouts- Runway configurations. Airport Landing Aids- Airport markings- Airport lighting- Air traffic control aids- landing Aids- ILS.

References:

1. Rao G. V., *Principles of Transportation Engineering*, Tata McGraw Hill, 1999.
2. Khanna S. K. and C. E. G. Justo, *Highway Engineering*, Nem Chand & Bros, 2011.
3. Kadiyali L. R., *Traffic Engineering and Transport Planning*, Khanna Publication, 2011.
4. Khanna S.K., M.G. Arora and S.S. Jain, *Airport Planning and Design*, Nem Chand & Bros., 1999.
5. Horonjeff R. M. and F. X. Mckelvey., *Planning and Design of Airports*, McGraw Hill, 2010.
6. Partha Chakraborty and Animesh Das, *Principles of Transportation Engineering*, Prentice Hall India Pvt. Ltd., 2015.
7. IRC : 37 : 2012 , *Guidelines for Design of Flexible Pavements*
8. Srinivasa Kumar R., *Highway Engineering*, Universities Press (India) Pvt. Ltd, 2011.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note:** No charts, tables, codes are permitted in the Examination hall. If necessary, relevant data shall be given along with the question paper by the question paper setter.*

Course Outcome:

After successful completion of the course, the students will have a basic understanding of the design features of highways and airport which will help them to be more technically sound.

13.606 COMPUTER PROGRAMMING AND NUMERICAL METHODS (C)

Teaching Scheme: 3(L) - 0(T) - 0(P) **Credits**: 3

Course Objective:

- *To provide adequate knowledge for writing programs using C++ language*
- *To develop C++ programmes to implement different computational methods used for the solution of engineering problems.*

Module – I

Introduction to computers-computer organisation-input output devices-secondary storage devices- programming languages- Computer programming- Elements of C++ programming language – Character set, tokens, data types, variables, key words and identifiers-Input & Output, operators, expressions. Selection statements – if, switch statements.

Module – II

Looping statements - for, while, do-while statements, Jump statements – break, continue, goto exit(). Arrays - single and multi-dimensional arrays, initializing array elements, pointers & arrays, Character arrays, string functions, Unformatted console I/O functions, Unformatted Stream I/O functions.

Module – III

User defined functions – Arguments, return values, call by value, call by reference, functions calling functions, functions and arrays - Global variables, automatic, static and register variables, recursive functions, Structures - functions and structures - Arrays of structures - structures within structures, Structures containing arrays. Files - Input & Output, sequential & random access.

Module – IV

Numerical methods:
Roots of transcendental equations - method of bisection and Newton-Raphson method, Numerical Integration - Trapezoidal and Simpson's rule, Solution of simultaneous linear equations using Gauss elimination method.

Write programs for the following:

1. To solve non-linear equations by method of bisection and Newton-Raphson method.
2. To implement numerical integration using Trapezoidal rule and Simpson's 1/3 rule
3. To solve general system of linear algebraic equations by Gauss elimination

References:

1. Balagurusamy E., *Programming in ANSI C*, Tata McGraw Hill, 2012.
2. Stephen G. Kochan, *Programming in C*, Macmillan Computer Pub., 2003.
3. Byron Gottfried, *Programming in C* -, McGraw-Hill, 1996.
4. Kamthane A., *Programming with ANSI & Turbo C*, Pearson Education, 2006.
5. Robert Lafore, *C++ Programming*, Sams Publishers, 4/e, 2001.
6. Maria Litvin and Gary Litvin, *Programming in C++*, Vikas Publishing House, 2002.
7. Jose S., *Computer Programming and Numerical Methods,* Pentagon Educational Services, Kollam, 2015.
8. Gerald C. F. and P. O. Wheatley, *Applied Numerical Analysis*, Pearson Education, 2004.
9. Kamthane A., *Object Oriented programming with ANSI & TURBO C++* , Pearson Education, 2003.
10. Balagurusamy E., *Object Oriented programming with C++* , Tata McGraw Hill, 2013.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks. Question from Module IV must be a programming exercise.

Course Outcome:

- *Students get confidence in writing their own programs.*
- *Their logical thinking capacity will be developed.*
- *They are able to solve problems easily using computers.*

13.607 TRANSPORTATION ENGINEERING LAB (C)

Teaching Scheme: 0(L) - 0(T) - 2(P) **Credits**: 2

Course Objective :

- *To achieve practical experience in testing of Pavement Materials*
- *To get familiar with standard quality laboratory testing procedures for determining the basic properties and engineering behaviour of soil, aggregates and bitumen*

List of Experiments:

1. Tests on Aggregates
   - (i) Crushing Value
   - (ii) Los-Angeles Abrasion Value
   - (iii) Impact Value
   - (iv) Specific Gravity
   - (v) Water Absorption
   - (vi) Shape Test – Flakiness Index, Elongation Index & Angularity Number
2. Tests on Bitumen
   - (i) Viscosity Test with Brookfield viscometer
   - (ii) Ductility Test
   - (iii) Softening Point Test
   - (iv) Specific Gravity
   - (v) Flash Point Test
3. Tests on Soil
   - (i) Modified Proctor Compaction Test
   - (ii) CBR Test

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test
40% - Class work and Record
20% - Regularity in the class

Reference:

Khanna S. K. and C. E. G. Justo, *Highway Engineering*, Nem Chand & Bros., Roorkee, 2011.

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions based on the list of experiments prescribed.

80% - Theory, Procedure and tabular column (30%);

Conducting experiment, Observation, Tabulation with Sample calculation (30%)

Graphs, Results and inference (20%)

20% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

After successful completion of the course, the students will be

- *Able to assess the basic and engineering properties of pavement materials.*
- *Capable of conducting specific tests required for field application and draw necessary inferences.*

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13. 608 COMPUTER AIDED DESIGN AND DRAFTING LAB (C)

Teaching Scheme: 0(L) - 0(T) - 2(P) **Credits**: 2

Course Objective :

- *To develop an ability to use CAD software for generating engineering drawings and, perform structural analysis & design using spreadsheets and softwares.*

List of Exercises:

1. Preparation of Civil Engineering Drawings – plan, section and elevation of buildings.

2. Application of spreadsheets in Civil Engineering:
   (i) BM and SF diagrams of cantilever, simply supported and overhanging beams.
   (ii) Analysis of continuous beams by moment distribution method.
   (iii) Design of singly/doubly reinforced sections by limit state method.

3. Use of structural analysis software: Analysis of cantilever and simply supported beams (Not to be included for examination)

4. Application of GIS in Civil Engineering – preparation of database and GIS analysis. (Not to be included for examination)

Note: *1. Any standard software packages can be used for drafting, spreadsheet, structural analysis and GIS.*

2. The printouts of the drawings and spreadsheets/structural analysis software should be attached in the lab record maintained by the students.

References:

The manuals of the software packages used.

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions based on the list of exercises prescribed in sections 1 and 2. Question on Civil Engineering Drawing is compulsory. Question paper may contain a question on CAD drawing and a Spread sheet analysis using software. 60% credit may be given for CAD drawing and 40% for spreadsheet analysis.

Marks should be awarded as follows:

40% - Working/Correctness of the procedure/equations (for spreadsheet analysis)

60% - Output/Results

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

- *The students after undergoing this course will be able to develop engineering drawings of residential buildings using CAD software, generate spreadsheets for analysis and design of beams and use structural analysis and GIS softwares.*