Curriculum for 2 Year M. Tech. Programme in Civil Engineering

M. Tech

Semester 1

S. No.	Course Code	Course Name	L-T-P	Load
1	CE-501	Advanced Structural Engineering	3-1-0	4
2	CE-505	Advance Water Supply & Wastewater Management	3-1-0	4
3		Departmental Elective - I	3-1-0	4
4		Departmental Elective - II	3-0-0	3
5		Departmental Elective - III	3-1-0	4
6	CE-520	Case Study	0-0-2	2
7	CE-521	Advanced Material Testing Lab	0-0-4	2
Total			**15-4-6**	**25**

M. Tech

Semester II

S. No.	Course Code	Course Name	L-T-P	Cr
1	CE-502	Construction Economics & Finance	3-1-0	4
2	CE-504	Design of Bridges	3-1-0	4
3	CE-506	Advanced Concrete Technology	3-1-0	4
4	CE-508	Construction Materials	3-0-0	3
5	CE-510	Advanced Design Of Steel Structure	3-1-0	4
6	CE-554	Minor Project	0-0-2	1
7	CE-556	Advanced Concrete Lab	0-0-4	2
Total			**15-4-6**	**22**

M. Tech

Semester III

S. No.	Course Code	Course Name	L-T-P	Load
1	CE-611	Seminar I	0-0-2	1
2	CE-613	Dissertation I	0-0-22	11
3		Departmental Elective – II	3-1-0	4
4		Departmental Elective - III	3-1-0	4
Total			**6-2-24**	**20**

M. Tech

Semester IV

S. No.	Course Code	Course Name	L-T-P	Cr
1	CE-612	Seminar-II	0-0-2	1
3	CE-614	Dissertation II	0-0-30	15
4		Departmental Elective - IV	3-1-0	4
Total			**3-1-32**	**20**

List of Departmental Electives

Departmental Elective – I		
S. No.	**Subject Code**	**Subject Name**
1	CE-511	Composite Materials
Departmental Elective - II		
2	CE-601	Advanced Engineering Geology
Departmental Elective - III		
3	CE -605	Construction & Maintainence Management
Departmental Elective - IV		
4	CE-602	Rehabilitation of Structures

Guidelines for Dissertation work

Preamble

These Guidelines are intended to give both students and teachers a set of procedures and expectations that will make the Dissertation evaluation process easier, more predictable, and more successful. These Guidelines should be interpreted as the minimum requirements of the degree awarded by Lingaya's Vidyapeeth, Faridabad. The Dissertation Committee assigned for various programmes offered by Lingaya's Vidyapeeth, Faridabad may add requirements or guidelines as deemed fit.

1.1 Dissertation Work

The Dissertation Work for M. Tech consists of Dissertation Work – I and Dissertation Work–II. ***Dissertation Work–I*** is to be undertaken during ***semester III*** and ***Dissertation Work–II***, which may be a continuation of Dissertation Work–I, is to be undertaken during ***semester IV.***

1.2 General Suggestions and Expectations

The Dissertation Work is by far the most important single piece of work in the post-graduate programme. It provides the opportunity for student to demonstrate independence and originality, to plan and organize a large Dissertation over a long period and to put into practice some of the techniques student have been taught throughout the course. The students are advised to ***choose a Dissertation that involves a combination of sound background research, a solid implementation, or piece of theoretical work, and a thorough evaluation of the Dissertation's output in both absolute and relative terms***. Interdisciplinary Dissertation proposals and innovative Dissertations are encouraged and more appreciable.
It is good to try to think of the Dissertation as a deliverable

- Postgraduate students are to decide on the Dissertation Work-I and Dissertation Work-II Dissertation with their proposal and Dissertation Teacher in the beginning of semester with a Synopsis consisting of **three chapters** - ***Introduction, Literature Review*** and ***Methodology, which*** should highlight the deliverables.
- In Case of re-reviews, any number of re-reviews can happen depending on the discretion of the committee and it should happen within the prescribed time.

- If the student fails to attend, the Teacher refuses to endorse the student's work. The committee can invite Head of the Department who is empowered to resolve among further matters.
- If the work of the candidate is found to *be insufficient and plagiarism*, the committee and Head of the Department will decide the further process.
- Head of the Department can initiate further steps to ensure the smooth implementation as deems appropriate of guidelines.

- Marks split-up

  Committee - 60 Marks (Each 10 marks)

  Teacher - 40 Marks

  Total - 100 marks

1.3 Choosing the Right Dissertation

The idea for student's Dissertation may be a proposal from a faculty member or student's own, or perhaps a combination of the two. The Dissertations offered by faculty member may vary substantially in breadth, depth and degree of difficulty. The most important thing is to shortlist a set of Dissertations that are right for *student.* Some students are better suited to well-defined and relatively safe Dissertations that provide scope for demonstrating proficiency with a low risk of failure. Other students are better advised to tackle harder, riskier Dissertations that require a high degree of original input and/or technical problem solving. The potential Teachers will be happy to offer advice on the suitability of a Dissertation, given student's individual background, strengths and ambitions. Remember that it is important to balance ambition and realism when making a choice. For better help of Dissertations student can search from websites like *(IEEE, ACM, Elsevier, Springer, NPTEL etc...)*

1.4 Internal Assessment of the Dissertation Work

- The assessment of Dissertation Work for I and II shall be done independently in the respective semesters and marks shall be allotted as per the weightages.
- There shall be ***two*** assessments ***(Phase-1 and phase-II***), by a departmental review committee formed by the HOD concerned during each of the dissertation work semesters for M.Tech. programmes (each 100 marks). The student shall make presentation on the progress made before the committee - one during middle of the

semester explaining the title and its implications and second presentation towards the end of the semester with spiral bound hard copy before the examination with enough time to incorporate the feedback after the presentation so that it can be finalized and submitted.

- The Dissertation Work shall be assessed for a maximum of 100 marks of which 30 marks will be through internal assessment. The Dissertation Work prepared according to approved Guidelines and duly signed by the Teacher(s) and the Head of the Department shall be submitted to the competent authorities.

- If the candidate fails to obtain 50% of the internal assessment marks in the Phase–I and Phase–II, he/she will not be permitted to submit the report for that particular semester. This applies to both Dissertation Work–I and Dissertation Work –II.
- Every candidate doing M.Tech. shall be encouraged to send a paper / patent for publication in a journal or a conference - preferably a concept paper related to their topic and a second paper highlighting their contribution and the results of their work. An acknowledgement from the Teacher for having communicated to the journal or conference shall be attached to the report of the Dissertation Work.
- A copy of the approved Dissertation report after the successful completion of viva examinations shall be kept in the library of the department.

1.5 Student-Proposals

If student has his/her own idea for an individual Dissertation, it is the student's responsibility to find a faculty member who both approves of the proposed programme of work and is willing to be the Teacher. Student should first get the permission of Dissertation Committee, and may proceed with the consistent consent of the Teacher.

1.6 Teacher

The Teacher can suggest Dissertation titles focusing more on the current field of research and ensure the level of innovation. Also, Teachers are advised to check for the formatting of the presentation and Dissertation report.

1.7 Teacher to Check

For Dissertations proposed by faculty member, student should discuss the Dissertation with the proposer as soon as possible so that student have plenty of time to think about the best choices for student. Note that every Dissertation is not suitable for every student; some may be specifically tailored to a particular degree and some may only suit students with a very specific set of interests. Each proposal will indicate these constraints in order to help student to make an informed choice.

- Advised to check for the formatting of the presentation and the documentation.
- Check for the attendance of the students (Regular meeting for the discussions)
- Advise the students to contribute some new techniques and publish a paper at the end of the Dissertation

1.8 Student's Meeting with Teacher

Student must make sure that s/he arranges regular meetings with Teacher. The meetings may be brief once student's Dissertation is under way but student's Teacher need to know that student's work is progressing. If student need to talk to the Teacher and cannot locate him/her in office, contact him/her asking for a time when s/he will be available. When a student goes to see the Teacher s/he should have prepared a written list of points s/he wish to discuss. Take notes during the meeting so that student does not forget the advice s/he was given or the conclusions that were reached.

1.9 Dissertation Committee

The Dissertation committee is advised to conduct the Dissertation reviews for the students of various programmes within the stipulated period and review the marks to be sent the HOD at the month end. The Dissertation committee is also advised to make necessary arrangements required (Seminar hall availability and Dissertation or, etc…) for the smooth conduct of reviews.

- The committee is advised to find the enough complexity in the Dissertation.
- All the three panel members must be present during the review.
- The reviews to be conducted in the seminar hall and the available class rooms (in the department).

1.10 Dissertation Presentation / Demonstration

The presentation is also a compulsory component of the Dissertation. The Dissertation committee will not allocate marks for a Dissertation unless there has been a formal presentation. One of the most important skills which the Dissertation aims to assess is student's ability to communicate his/her ideas and work. The objective of the presentation is to find out exactly what s/he seem to have done and to ensure that s/he get relevant marks that is consistent with other Dissertations. As part of the assessment, the student will be required to give a presentation and demonstration of his/her Dissertation to the Dissertation Committee. Each presentation will be for 30 minutes. Teachers will help him/her to structure the talk and be willing to go through it with student beforehand. Other PG students could be encouraged to attend the presentations as observers only, as the feedback by the committee will benefit everybody.

1.11 Dissertation Work-I Requirements: M.Tech.

First Review Within 8 Weeks	**Second Review** Within 16 Weeks
• Title • Abstract • Introduction • Literature Survey • References	• Title • Abstract • Introduction • Literature Survey • Methodology • Modules Split-up and Gantt Chart • Proposed System (Phase 1) • Equations /Design and software to be used • Algorithms / Techniques used • Expected outcomes

Detailed Contents

Semester One

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CE-501	Advanced Structural Analysis	3-1-0	4	60	40	100	3 hours

1. **Stiffness Method (Systems Approach):** Basis of stiffness method, Degrees of freedom, Force-displacement relationships, Nodal stiffness.

2. **Flexibility Method (Systems Approach):** Flexibility coefficients, Basis of the method, Application to various types of structures.

3. **Introduction to Element Approach:** Member stiffness matrix, Local or Member co-ordinate system, Global or Structural co-ordinate system, Rotation of axes etc, Structure stiffness matrix.

4. **Structural Stability Analysis:** Elastic Instability, Introduction to stability problem, Energy methods, buckling of axially loaded members for different end conditions, Concept of effective length, approximate techniques, Stability analysis of beam-column and frames.

5. **Plastic Analysis:** Concept of Limit load analysis, Upper and lower bonds, Plastic analysis of beams and multi-storey frames using mechanism method.

6. **Non Linear Analysis:** Introduction to geometric and material non-linearity.

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CE-505	ADVANCE WATER SUPPLY & WASTEWATER	3-1-0	4	60	40	100	3 hours

1 Wastewater Characteristics and Effluent Standards: Physical, chemical and biological parameters of water pollution; Solids (volatile and non-volatile solids; suspended, dissolved and colloidal solids); Biodegradable and non-biodegradable organic matter (DO, COD, BOD and BOD kinetics); Nutrients (TKN, total nitrogen, and total and ortho-phosphorus); Sulfides, phenols, cyanides, heavy metals and recalcitrant/toxic organic compounds; Effluent standards.

2. Overview of Wastewater Treatment Technologies: Preliminary, primary, secondary and tertiary treatment technologies; Overview of biological treatment technologies; Biological treatment technologies for the tertiary treatment.

3. Preliminary Treatment: Screens; Grit removal facilities – grit channels, vortex degritters and cyclonic degritters, aerated grit chambers; Effluent sumps and pumps; Equalization tanks – flow and strength equalization, and online and offline equalization tanks.

4. Primary Treatment: Neutralization and precipitation; Primary and secondary sedimentation tanks; Membrane filtration processes; Roughing filters.

5. Biological Treatment: Activated sludge process and its modifications including SBR; Trickling filters and RBC units; SAF, FAB and MBBR technologies; UASB reactors and its modifications including anaerobic baffled reactor and anaerobic moving bed reactor; Waste stabilization pond systems and its modifications including vegetated ponds and constructed wetlands. **Other Treatment Technologies:** Advanced oxidation processes; Biological nutrient removal; Filtration and chlorination; Membrane processes for TDS reduction; Wet oxidation process.

Recommended Books

1. Metcalf, Eddy ,Tchobanoglous, G., Burton, F.L., Stensel, H.D., Wastewater. Engineering – Treatment, Disposal and Reuse, Tata McGraw Hill (2002) 4th ed.
2. Eckenfelder WW Jr., Industrial Water Pollution Control, McGraw Hill (2003) 3rd ed.
3. Biological Wastewater Treatment, Edited Volume Series, IWA (2008).

Semester Second

Subject Code	Subject Name	L-T-P	Cr	ESE	Internal Assessment	Total	Duration
CE-502	Construction Economics & Finance	3-1-0	4	60	40	100	3 hours

Engineering economics, Time value of money, discounted cash flow, 180 NPV, ROR, PI. Basis of comparison, Incremental rate of return, Benefitcost analysis, Replacement analysis, Break even analysis. Depreciation and amortization. Taxation and inflation, Evaluation of profit before and after tax. Risks and uncertainties and management decision in capital budgeting. Working capital management, financial plan and multiple source of finance. Budgeting and budgetary control, Performance budgeting. Profit & Loss, Balance Sheet, Income statement, Ratio analysis, Appraisal through financial statements, International finance, forward, futures and swap. Practical problems and case studies.

UNIT I - ADVANCES IN CIVIL ENGINEERING Role of civil engineering in industrial development - Advances in civil engineering and engineering economics - Support matters of economy as related to engineering Market demand and supply- choice of technology and quality control and quality production - Audit in economic, Law of returns governing production

UNIT II - MATERIAL SELECTION Construction development in housing, transport and other infrastructures –Economics of ecology, environment, energy resources, local material selection, form and functional designs –Construction workers - Urban problems - Poverty - Migration - Unemployment - Pollution.

UNIT III - NEED FOR FINANCIAL MANAGEMENT The need for financial management - Types of financing - Short term borrowing - Long term borrowing –Leasing - Equity financing - Internal generation of funds - External commercial borrowings - Assistance from government budgeting support and international finance corporations - analysis of financial statement – Balance Sheet - Profit and Loss account - Funds flow statement - Ratio analysis - Investment and financing decision –Financial control Job control and centralized management.

UNIT IV - OVERVIEW OF CASH BASIS ACCOUNTING General overview - Cash basis of accounting - Accrual basis of accounting - Percentage - Completion method - Completed contract method - Accounting for tax reporting purposes and financial reporting purposes.

UNIT V - CONTRACTOR FINANCING Loans to contractors - Interim construction financing - Security and risk aspects.

REFERENCES

1. Warneer Z, Hirsch, "Urban Economics", Macmillan, New York, 2003.

2. Prasanna Chandra, " Project Management ", TMH,2007.

3. Kwaku A, Tenah and jose M.Guevara, " Fundamental of Construction Management and organisation ", Prentice - Hall of India, 2005.

4. Chitkara .K.K, "Construction Project Management", Tata McGraw Hill.2008.

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CE-504	**Design of Bridges**	**3-1-0**	**4**	**60**	**40**	**100**	**3 hours**

1. **Types of bridges super structure:** introduction and types, temporary bridge superstructures, military bridges, other temporary bridges, permanent bridges, R.C.C. bridges, Pre-stressed concrete bridges, steel bridges, movable steel bridges.
2. **Consideration of loads and stress in road bridges:** introduction, loads, forces and stresses, dead loads, bridge loading as per relevant IRC and IRS specifications, traffic lanes, foot way, kerb, railing and parapet loading, impact, wind load, longitudinal forces, Temperature effects, secondary stresses, erection stresses, earth pressure, effect of live load on backfill and on the abutment.
3. **Design OF R.C. Bridges:** Slab culvert, box culvert, pipe culvert, T-beam bridge superstructure, design examples, brief introduction to rigid frame, arch and bow string girder bridges.
4. **Design of prestressed concrete bridges:** Pre-tensioned and Post tensioned concrete bridges, analysis and design of multi lane pre stressed concrete T-beam bridge superstructure.
5. **Pier, Abutment and wing walls:** Introduction, types of piers, design of piers, forces On piers, stability, abutments, bridge code provisions for abutments, wing walls, design examples.
6. **Bearings:** Introduction, function of bearings, bearings for steel bridges and concrete bridges, bearings for continuous span bridges, I.R.C. provision for bearings, fixed bearings, expansion bearings, materials and specifications, permissible stresses in bearings, design consideration for rocker and roller-cum-rocker bearings, sliding bearings.

Subject Code	Subject Name	L-T-P	Cr	ESE	Internal Assessment	Total	Duration
CE-506	Advanced Concrete Technology	3-1-0	4	60	40	100	3 hours

Hydration of cements and microstructural development, Mineral additives, Chemical admixtures, Rheology of concrete, Creep and relaxation, Shrinkage, cracking and volume stability, deterioration processes, special concretes, Advanced characterisation techniques, sustainability issues in concreting, Modelling properties of concrete.

UNIT I - COMPOSITION CEMENT Composition of OPC -Manufacture - Modified Portland Cements - Hydration process of Portland Cements - Structure of Hydrated Cement Pastes.

UNTI II - MECHANICAL PROPERTIES Particle characteristics and Mechanical Properties - Absorption and Physical Durability - Chemical Stability - Packing Characteristics.

UNTI III - MINERAL ADMIXTURES Mineral Admixtures - Slags - Pozzolanas and Fillers - Chemical Admixtures - Solutes – Retarders - Air Entraining Agents - Water Proofing Compounds - Plasticizers and Super Plasticizers.

UNIT IV - PERFORMANCE OF CONCRETE Workability - Mix Proportioning - Mixes incorporating Fly-Ash - Mixes for High Performance Concrete - Interfacial Transition Zone - Fracture Strength - Mechanical Properties, Fresh concrete and Hardened concrete - High Strength Concrete - Shrinkage - Creep . Durability of Concrete - Basic Consideration - Stability of Constituents - Chemical Attack - Corrosion of Reinforcing Steel-Use of inhibitors and types of inhibitors.

UNIT V - PROPERTIES AND APPLICATIONS OF CONCRETE Introduction to treatment on properties and applications - Fiber Reinforced Concrete – Polymer Concrete – Self Compacting Concrete –Reactive powder concrete – Roller compacted concrete – Geo polymer concrete – Bio concrete- - Recycled aggregate concrete – High volume fly ash concrete - Ready Mixed Concrete –Sulphur infiltrated impregnated concrete-Extreme weather concreting-Special Concreting methodsMaterials used in Highway Pavements.

REFERENCES

1. Metha P.K and Monteiro.P.J.M, “Concrete, Microstructure, Properties and Materials”, Third Edition, Tata McGraw- Hill Publishing company Limited, New Delhi, 2006.

2. Shetty .M.S., “Concrete Technology, Theory and Practice”, Revised Edition, S. Chand & company Ltd., New Delhi, 2006.

3. Neville. A.M., “Properties of Concrete”, 4th Edition Longman,2005.

4. Mindass and Young, “Concrete”, Prentice Hall.1998. 5. Aitcin – “High performance concrete”, McGraw Hill, 2009.

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CE-508	Construction Materials	3-0-0	3	60	40	100	3 hours

Unit :1. Classification & Criteria for selection of building materials (e.g. Stones, Bricks – Concrete Blocks- Fly ash, Lime – Cement – Aggregates – Mortar) Tests on stones – Bricks — Tests on bricks

– Compressive Strength – Water Absorption – Efflorescence –) Types and Grades, Compressive strength &Tensile strength – Properties of cement and Cement mortar – Hydration– Aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading – Sand Bulking.

Unit:2. Concrete – Ingredients – RMC – Properties of fresh concrete – Slump – Flow and compaction Factor – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method – High Strength Concrete and

– Behaviour of all types of concretes – Properties and Advantages of High Strength and High Performance Concrete, Applications of Fibre, Reinforced Concrete, Self-compacting concrete, Alternate Materials to concrete.

Unit:3. Timber– Industrial timber– Plywood –Thermacole, paints for various uses,– Bitumens–Types and properties of Water Proofing Compounds – Types of Non-weathering Materials and its uses – Types of Flooring and Facade Materials and its application.

Unit.4 Types of Steels and Advantages of new alloy steels – Properties and advantages of aluminium and its products – Types and applications of Coatings & Coatings to reinforcement

Unit:5. Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractory – Composite materials – Types &Applications of laminar composites – Fibre textiles – Geo-membranes and Geo-textiles for earth reinforcement. Advantages of Reinforced polymers – Types of FRP its Applications.

Suggested Readings:

- Varghese. P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2012.
- Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
- Shetty. M.S., "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd.,2008.
- Gambhir. M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Education, 2004
- Duggal. S.K., "Building Materials", 4th Edition, New Age International, 2008. Jagadish K.S, "Alternative Building Materials Technology", New Age International, 2007.
- IS456 – 2000: Indian Standard specification for plain and reinforced concrete, 2011
- IS4926–2003 : Indian Standard specification for ready–mixed concrete, 2012

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CE-510	**Advanced Design of Steel Structures**	**3-1-0**	**4**	**60**	**40**	**100**	**3 hours**

1. **Introduction to Limit States:** Introduction, standardization, allowable stress design limit state design, partial safety factors, concept of section classification: Plastic, compact, semi-compact & slender.
2. **Columns:** Basic concepts, strength curve for an ideal strut, strength of column member in practice, effect of eccentricity of applied loading, effect of residual stresses, concept of effective lengths, no sway & sway columns, torsional and torsional flexural buckling of column, Robertson design curve, modification to Robertson approach, design of column using Robertson approach.
3. **Laterally restrained beams:** Flexural& shear behavior, web buckling & web crippling, effect of local buckling in laterally restrained plastic or compact beam combined bending & shear, unsymmetrical bending.
4. **Unrestrained beam:** Similarity of column buckling & lateral buckling of beams lateral torsional buckling of symmetric section, factor affecting lateral stability, buckling of real beam, design of cantilever beams, continuous beam.
5. **Beam columns:** Short & long beam column, effect of slenderness ratio and axial force on modes of failure, beam column under biaxial bending, strength of beam column, local section failure & overall member failure.
6. **Beam subjected to torsion and bending:** Introduction, pure torsion and warping, combined bending and torsion, capacity check, buckling check, design method for lateral torsional buckling.
7. **Connection design:** Complexities of steel connections, type of connection, connection design philosophies, welded and bolted connection: truss connection, portal frame connection, beam& column splices, beam to beam and beam to column connections.

Subject Code	Subject Name	L-T-P	Cr	CW	External Assessment	Total	Duration
CE-556	Advanced Concrete Technology Lab	0-0-4	2	60	40	100	2 hours

List of Experiments.

1	Stress strain curve for concrete
2	Correlation between cube strength and cylinder strength
3	Determination of split tensile concrete
4	Determination of modulus of rupture concrete
5	Correlation between compressive strength and cylinder strength
6	Relation between compressive and modulus of rupture
7	Non-destructive testing of existing concrete members
8	Behavior of beams under flexur
9	Behavior of beams under shear
10	Behavior of beams under torsion

Semester Third

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-505	Dissertation Work-I	0-0-30	12	30	20	100	3 hours

M. Tech thesis part 1.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-503	Seminar-I	0-0-6	6	30	20	50	3 hours

Seminar on Dissertation Work-I.

Semester IV

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-603	Seminar-II	0-0-6	6	30	20	50	3 hours

Seminar on Dissertation Work-II.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-605	Dissertation Work-II	0-0-30	12	30	20	100	3 hours

M. Tech thesis part 2.

Detailed Syllabus of Departmental Electives

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CE-511	Composite Materials	3-1-0	4	60	40	100	3 hours

1. Fibre Reinforced Concrete: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Composite Material approach, Application of fibre reinforced concrete.

2. Fly Ash Concrete: Classification of Indian Flyashes, Properties of Flyash, Reaction Mechanism, Proportioning of Flyash concretes, Properties of Flyash concrete in fresh and hardened state, Durability of flyash concrete.

3. Polymer Concrete: Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete.

4. Ferro Cement: Constituent materials and their properties, Mechanical properties of ferro cement, Construction techniques and application of ferro cement.

5. High Performance Concrete: Materials for high performance concrete, Supplementary cementing materials, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.

6. Sulphur Concrete And Sulphur Infiltrated Concrete: Process technology, Mechanical properties, Durability and applications of sulphur concrete, Sulphur infiltrated concrete, Infiltration techniques, Mechanical properties, Durability and applications of sulphur infiltrated concrete.

7. Light Weight Concrete: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete.

Books recommended:

1. Concrete Technology-A.M. Nevillie
2. Concrete Technology-M.L. Gambhir.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-601	Advanced Engineering Geology	3-1-0	4	60	40	100	3 hours

1. Geology vs. Engineering, Role of geology in planning, design and construction of major man-made structural features. Engineering properties of rocks.

2. Site investigation and characterization. Geological consideration for evaluation of dams and reservoirs sites; dam foundation problems; reservoir problems.

3. Geological conditions for tunnelling. Soft and hard rock tunnelling. Importance of lithology, structure and water in tunnelling. Foundation treatment; Grouting, Rock Bolting and other support mechanisms.

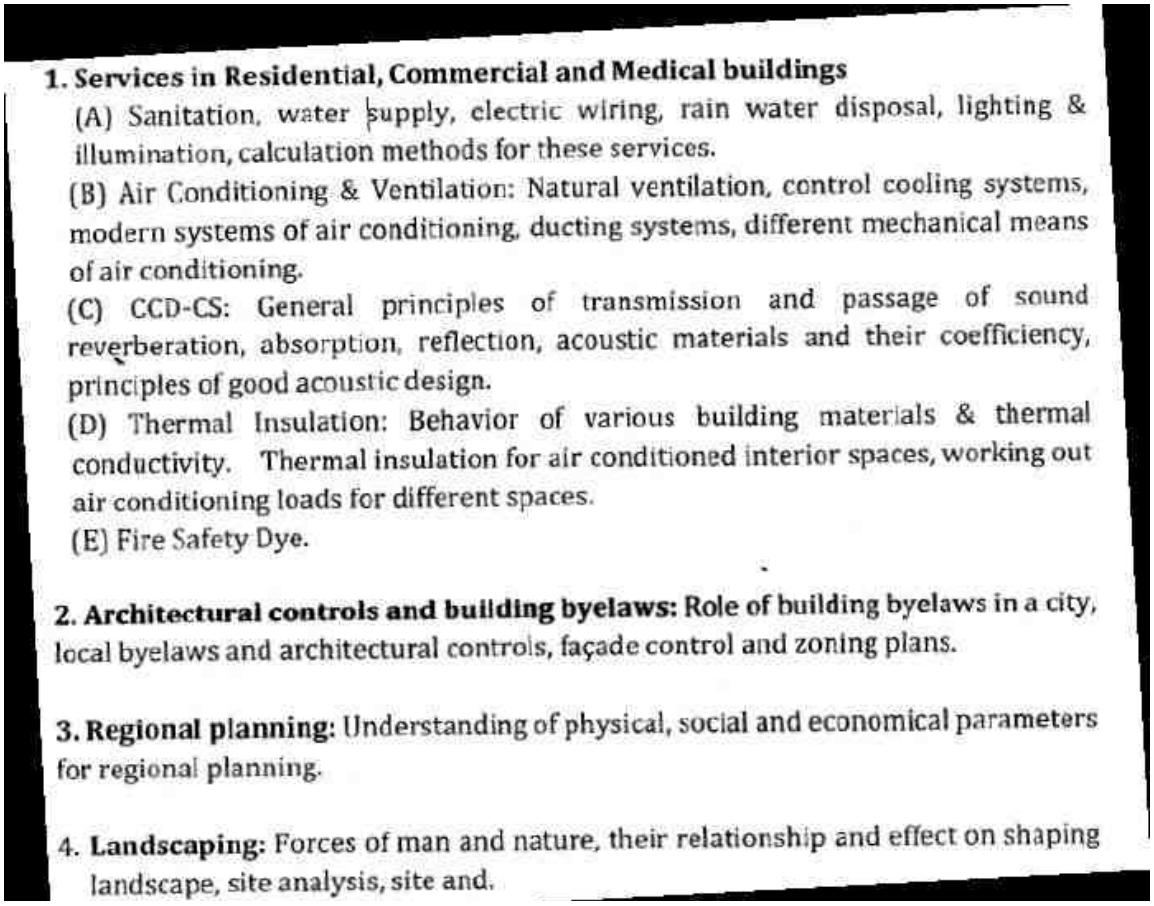
4. Landslides; Causes, Factors and corrective/Preventive measures.

5. Earthquakes; Causes, Factors and corrective/Preventive measures; seismic zones of India; aseismic design of building.

SUGGESTED READINGS:

1. Krynin, D.P. and Judd W.R. 1957. Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publication).
2. Johnson, R.B. and De Graf, J.V. 1988. Principles of Engineering Geology, John Wiley.
3. Goodman, R.E., 1993. Engineering Geology: Rock in engineering constructions. John Wiley & Sons, N.Y.
4. Waltham, T., 2009. Foundations of Engineering Geology (third Edition.) Taylor & Francis.
5. Bell: F.G-, 2006. Basic Environmental and Engineering Geology Whittles Publishing.
6. Bell, .F.G, 2007. Engineering Geology, Butterworth-Heineman.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-604	Construction and Maintenance Management	3-1-0	4	60	40	100	3 hours



1. Services in Residential, Commercial and Medical buildings

(A) Sanitation, water supply, electric wiring, rain water disposal, lighting & illumination, calculation methods for these services.

(B) Air Conditioning & Ventilation: Natural ventilation, control cooling systems, modern systems of air conditioning, ducting systems, different mechanical means of air conditioning.

(C) CCD-CS: General principles of transmission and passage of sound reverberation, absorption, reflection, acoustic materials and their coefficiency, principles of good acoustic design.

(D) Thermal Insulation: Behavior of various building materials & thermal conductivity. Thermal insulation for air conditioned interior spaces, working out air conditioning loads for different spaces.

(E) Fire Safety Dye.

2. Architectural controls and building byelaws: Role of building byelaws in a city, local byelaws and architectural controls, façade control and zoning plans.

3. Regional planning: Understanding of physical, social and economical parameters for regional planning.

4. **Landscaping:** Forces of man and nature, their relationship and effect on shaping landscape, site analysis, site and.

Books Recommended:

1. Building Repair and Maintenance Management by P. S. Gahlot

2. Maintenance of Buildings by A C Panchdhari.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-611	Bridge Engineering	3-0-0	4	60	40	100	3 hours

UNIT - I

Types of Bridges: Consideration of loads and stresses in bridges, bridge loading as per IRC and IRS specifications, traffic lanes, footway, kerbs, railing and parapet loading, impact, wind load, longitudinal forces, temp effects, secondary stresses, erection stresses, earth pressure, effect of live load on back fill and on the abutment.

UNIT – II

Design of RC Bridges: Slab culvert, box culvert, pipe culvert, T-beam bridge, super structure, design examples, brief introduction to rigid frame, arch and bow string girder bridges. Design of pre-stressed concrete bridges, pre-tensioned and post tensioned concrete bridges, analysis and design of multi-lane prestressed concrete T-beam bridge super structure.

UNIT – III

Steel Bridges: Types, economical span, loads, permissible stresses, fluctuation of stresses, secondary stresses, plate girder bridges, general arrangement, bridge floors, plate girder railway bridges, deck type plate girder bridges, design example. Truss bridges, types, wind force on lattice Girder Bridge, bracings, truss bridge for railway – through type truss bridge. Pier, abutment and wing walls, types of piers, forces on piers, stability, abutments, bridge code provisions for abutments, wing walls, design examples.

UNIT – IV

Bearings: Functions, bearings for steel and concrete bridges, bearings for continuous span bridges, IRC provisions for bearings, fixed bearings, expansion bearings, materials and specifications, permissible stresses, design considerations for rocker and roller cum rocker bearings, sliding bearings.

UNIT- V

Foundations, types, general design criterion, design of well and pile foundations for piers and

Abutments.

Suggested Readings:

(i) Victor DJ, Essentials of Bridge Engineering, Oxford & IBH Pubb Co.

(ii) Rowe RE, Concrete ridge Design

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-612	CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT	3-1-0	4	60	40	100	3 hours

Earth's Climate System: Introduction-Climate in the spotlight - The Earth's Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies - Cloud Formation and Monsoon Rains – Storms and Hurricanes – The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation – The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

2. Observed Changes And Its Causes: Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of 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 – climate change modeling.

3. Impacts Of Climate Change: 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. 4. Climate Change Adaptation And Mitigation Measures: Adaptation Strategy/Options in various sectors – Water – Agriculture –- Infrastructure and Settlement including coastal zones – Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry – 5. Carbon sequestration – Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation. Recommended Books:

1. Anil Markandya , Climate Change and Sustainable Development: Prospects for Developing Countries, Routledge, 2002

2. Heal, G. M., Interpreting Sustainability, in Sustainability: Dynamics and Uncertainty, Kluwer Academic Publ., 1998

3. Jepma, C.J., and Munasinghe, M., Climate Change Policy – Facts, Issues and Analysis, Cambridge University Press, 1998

4. Munasinghe, M., Sustainable Energy Development: Issues and Policy in Energy, Environment and Economy: Asian Perspective, Kleindorfor P. R. et. al (ed.), Edward Elgar, 1996

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-604	**Rehabilitation of Structures**	3-1-0	4	60	40	100	3 hours

1. **Maintenance and repair strategies:** Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of distress and deterioration of concrete- Evaluation of existing buildings through field investigations, Seismic evaluation of existing buildings
2. **Serviceability and durability of concrete:** Quality assurance for concrete construction concrete properties - strength, permeability, thermal properties and cracking. – Effects due to climate, temperature, chemicals, corrosion – design and construction errors – Effects of cover thickness and cracking.
3. **Materials and techniques for repair:** Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning - Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection.
4. **Repairs, rehabilitation and retrofitting of structures:** Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure - Special techniques for structural Retrofitting (Bracing, Shear walls, Base isolation etc).
5. **Demolition techniques:** Engineered demolition techniques for Dilapidated structures – case studies - Case Studies on Restoration of fire damaged buildings, Case study on repairs and strengthening corrosion damaged buildings; Case study on use of composite fibre wraps for strengthening of building components.