



**DEPARTMENT OF CIVIL ENGINEERING  
(DCE)**

**Course of Study**

**Master of Technology (M.Tech)**

**Civil Engineering (CE)**

**(Transportation Engineering)**

**Lingaya's Vidyapeeth, Faridabad**

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## M. Tech (Transportation Engineering)

1 <sup>st</sup> Year SEMESTER – I					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CE-501-T	Highway Planning and Geometric Design	3-1-0	4
2	PCC	CE-503-T	Advanced Railway Engineering	3-1-0	4
3	PCC	CE-505-T	Construction Project Management	3-1-0	4
4	PEC	CE-507-T	Departmental Elective – I (Engineering Geology)	4-0-0	4
5	PCC	CE-521-T	Transportation Engineering Lab/Case Study	0-0-4	2
				<b>13-3-4</b>	<b>18</b>

1 <sup>st</sup> Year SEMESTER – II					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CE-504-T	Analysis & Structural Design of Pavements	3-1-0	4
2	PCC	CE-506-T	Mass Transit System	3-1-0	4
3	PCC	CE-508-T	Transportation & Environment	3-1-0	4
4	PEC	CE-512-T	Departmental Elective II (Construction Materials)	3-1-0	4
5	PCC	CE-522-T	Traffic & Transportation Engineering Laboratory / Case Study	0-0-4	2
6	PCC	CE-526-T	Minor Project	0-0-4	2
				<b>12-4-8</b>	<b>20</b>

## M. Tech (Transportation Engineering)

2 <sup>nd</sup> Year SEMESTER – III					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CE-601-T	Airport, Docks & Harbour	3-1-0	4
2	PEC	CE-611-T	Departmental Elective III (Bridge Engineering)	3-1-0	4
3	PCC	CE-623-T	Dissertation Work-I	0-0-12	6
4	PCC	CE-625-T	Seminar-I	0-0-8	4
				<b>6-2-20</b>	<b>18</b>

2 <sup>nd</sup> Year SEMESTER – IV					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CE-622-T	Seminars – II	0-0-8	4
2	PCC	CE-624-T	Dissertation Work-II	0-0-24	12
3	PCC	CE-626-T	Teaching Practice	0-0-8	4
				<b>0-0-40</b>	<b>20</b>

## List of Departmental Electives

Departmental Elective - I		
S. No.	Subject Code	Subject Name
1.	CE-511-T	Advanced Engineering Geology
Departmental Elective - II		
4.	CE-512-T	Construction Material
Departmental Elective - III		
7.	CE-611-T	Bridge Engineering

# 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 University, Faridabad. The Dissertation Committee assigned for various programmes offered by Lingaya's University, 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-I 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
<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Introduction</li><li>• Literature Survey</li><li>• References</li></ul>	<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Introduction</li><li>• Literature Survey</li><li>• Methodology</li><li>• Modules Split-up and Gantt Chart</li><li>• Proposed System (Phase 1)</li><li>• Equations /Design and software to be used</li><li>• Algorithms / Techniques used</li><li>• Expected outcomes</li></ul>



## Dissertation Evaluation Form

### M.Tech – DW-I

### III Semester

**Dissertation Title : FIRST REVIEW**

<b>Candidate Details</b>			
Sl. No	University Register/ Roll No.	Candidate Name	Teacher
<b>Candidate Contribution and Performance</b>			
Subject Matter		Marks	
Understanding background and topic			
Specifies Dissertation goals			
Literature Survey			
Dissertation Planning			
Question and Answer			
Presentation skills			
<b>Total</b>			
<b>C o m m e n t s</b>			

**Member 1**

**Member 2**

**Member 3**

**HOD**



# Dissertation Evaluation Form

## M.Tech – DW-I

### III Semester

**Dissertation Title : SECOND REVIEW**

Candidate Details			
Sl.No	University Registration / Roll No	Candidate Name	Teacher

Candidate Contribution and Performance	
Subject Matter	Marks
Abstract	
Specifies Dissertation goals	
Literature Survey	
Summaries algorithms and highlights the Dissertation features	
Specifies the testing platforms and benchmark systems	
Dissertation Planning	
Technical Design	
Summarises the ultimate findings of the Dissertation	
Implementation (60 Percentage)	
Question and Answer	
Presentation skills	
<b>Total</b>	
<b>C o m m e n t s</b>	

**Member 1**

**Member 2**

**Member 3**

**HOD**

## 1.12 Dissertation Work-II Requirements: M.Tech.

First Review Within 4 Weeks	Second Review Within 16 Weeks
<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Work completed for Phase I</li><li>• Expected outcomes</li><li>• Draft copy of conceptual paper</li><li>• References</li></ul>	<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Work completed for Phase II</li><li>• Detailed Design (if any deviation)</li><li>• Contribution of the candidate</li><li>• Experimental Results</li><li>• Performance Evaluation</li><li>• Comparison with Existing system</li><li>• Result Analysis and Conclusion</li><li>• References</li><li>• Draft copy of a dissertation for publishing</li></ul>

**Note:**

- The presentation should have maximum of 30 slides
- Presentation will be for 30 minutes
- A draft copy of the conference paper to be prepared at the end based on the Dissertation Work.
- System to be tested using testing software's.



# Dissertation Evaluation Form

## M.Tech – DW-II

### IV Semester

**Dissertation Title:** FIRST REVIEW

Candidate Details			
Sl. No.	University Registration/ Roll No	Candidate Name	Teacher

Candidate Contribution and Performance	
Subject Matter	Marks
Abstract	
Work to be completed in Phase 1	
Architecture /System Design – Phase 1 and 2	
Work to be completed in Phase 2	
Summaries the techniques implemented / to be implemented	
Contribution of the Candidate	
Results obtained and Summaries the ultimate findings of the Dissertation	
Implementation (60 Percentage)	
Question and Answer	
Presentation skills	
<b>Total</b>	
<b>C o m m e n t s</b>	

**Member 1**

**Member 2**

**Member 3**

**HOD**



# Dissertation Evaluation Form

## M.Tech – DW-II

### IV Semester

**Dissertation Title: SECOND REVIEW**

Candidate Details			
Sl. No.	University Registration No	Candidate Name	Teacher

Candidate Contribution and Performance	
Subject Matter	Marks
Abstract	
Architecture /System Design – Phase 2	
Overall Architecture /System Design – Phase 2	
Summarises the techniques implemented	
Contribution of the Candidate	
Results obtained and Performance Evaluation	
Summarises the ultimate findings of the Dissertation	
Implementation (100 Percentage)	
Pre-final draft of entire dissertation	
Draft of the paper to be published	
Question and Answer	
Presentation skills	
<b>Total</b>	
<b>Comments</b>	

**Member 1**

**Member 2**

**Member 3**

**HOD**

## Detailed Contents

### Semester First

Course Code	Course Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CE-501-T	Highway Planning and Geometric Design	3-1-0	4	60	40	100	3 hr

#### **UNIT –I**

Planning: Description of urban and regional transportation systems, Definition of a system; System analysis: scope and limitations, Transportation planning based upon system Analysis, Survey and analysis of existing conditions.

Highway Alignment: Requirements. Factors controlling alignment. Obligatory points. Engineering Surveys for highway location. Route selection. Steps in new project. Highway classifications.

#### **UNIT –II**

Cross Sectional Element: Pavement surface characteristics. Factors affecting skid resistance. Pavement unevenness. Camber. Providing camber in the field. Width of carriageway. Design Vehicle, Medians, kerbs, road margins, right of way and typical cross-sections of roads.

#### **UNIT -III**

Sight Distances: Introduction. Stopping sight distance. Reaction time. Analysis of stopping distance. Overtaking sight distance. Analysis of overtaking sight distance. Effect of grade on sight distances. Overtaking zone. Intermediate sight distance. Sight distance at intersections. Super elevation: Requirement of super elevation. Limits and attainment of super elevation in the field.

#### **UNIT –IV**

Highway Alignment: General. Design speed. Horizontal curves. Super elevation. Analysis of super elevation. Super elevation design. Attainment of super elevation. Widening of pavement on horizontal curves. Methods of introducing extra widening. Horizontal Transition curves. Different types of transition curves. Length of transition curve. Setting out of transition curve. Set-back distance on horizontal curves. Curve resistance.

#### **UNIT –V**

Vertical Alignment: General. Gradients. Compensation in gradient on horizontal curves. Vertical curves. Summit curve. Length of summit curve. Valley Curve. Length of valley curve and profile. Relevant IRC standards for urban and rural roads.

#### **Suggested Reading;**

1. L.R. Kadiyalli, Traffic Engineering and Transport Planning, Khanna Publishers, 7th Edition, 2008
2. C. S. Papacostas, P. D. Prevedouros, Transportation Engineering and Planning, PHI Publication, 3rd edition, 2002
3. Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.
4. Highway Engg. by S.K. Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
5. Principles and Practice of Highway Engg. by L.R. Kadiyali, Khanna Publishers, Delhi.
6. Principles of Transportation and Highway Engineering by G.V. Rao, Tata McGraw-Hill Publishing Co. Ltd. N. Delhi.
7. MORTH Specifications for Road and Bridge Works, IRC Publication.



Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CE-603-T	Advanced Railway Engineering	3-1-0	4	60	40	100	3 hours

**Unit 1.** Railway Transportation and its development, Long-term operative plans for Indian Railways. Classification of Railway lines and their track standards, Railway terminology, Traction and tractive

**Unit 2.** Resistance, Hauling capacity and tractive effort of locomotives, different Types of Tractions.

**Unit 3.** Permanent Way: Alignment Surveys, Requirement, gauges, track section, Coning of wheels, Stresses in railway track, high-speed track. Geometric design of railway track, Gauge, Gradient, speed, super elevation, cant deficiency, Negative super elevation, curves, length of transition curves, grade compensations.

**Unit 4.** Railway track components: Important features, Railway curves, Super elevation, Gradients and grade compensation, Points and crossing and their design approaches. ; Construction and maintenance of railway track, Control of train movements; Signals and interlocking,

**Unit 5.** Modernisation of railways and future trends; Track standards and track rehabilitation.

### Suggested Readings:

1. J.S. Mundrey, Railway Track Engineering, Tata McGraw Hill Co. Ltd., 3rd Edition, 2000.
  2. M.M. Agarwal, Railway Track Engineering, Standard Publishers, 1st Ed. 2005.
- Supplementary Reading: 1. S. Chandra and Aqarwal, Railway Engineering, Oxford University Press, 1st Ed. Feb 2008. 2. A.D. Kerr, Fundamentals of Railway Track Engineering, Simmons Boardman Pub Co (December 30, 2003).

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CE-505-T	Construction Project Management	3-1-0	4	60	40	100	3 hr

### **Unit I**

Project Management: Basic forms of organization with emphasis on Project; Project life cycle, planning for achieving time, cost, quality, project feasibility reports based on socio-techno-economic-environmental impact analysis, project clearance procedures and necessary documentation for major works like dams, multi-storeyed structures, ports, tunnels, Qualities, role and responsibilities of project Manager, Role of Project Management Consultants, Web based project management.

### **Unit II**

Project Scheduling: Construction Scheduling, Work break down structure, activity cost and time estimation in CPM, PERT, techniques, Precedence Network Analysis.

### **Unit III**

Project Controlling: Monitoring and Control, Crashing, Resource Levelling, Updating. Work Study: Definition, Objectives, and basic procedure, and method study and work measurement.

### **Unit IV**

Work-study applications in Civil Engineering. Method study – Definition, Objective, Procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, string diagrams.

### **Unit V**

Work measurement – Time and motion studies, Concept of standard time and various allowances, time study, equipment performance rating.

### **Suggested Readings;**

- 1 Construction Planning & management By P S Gahlot & B M Dhir, New Age International Limited Publishers
2. Construction Project planning & Scheduling By Charles Patrick, Pearson, 2012
- 3 Construction Project Management Theory & practice --- Kumar Neeraj Jha, Pearson, 2012

4. Construction management Fundamentals by Knutson, Schexnayder, Fiori, Mayo, TataMcGraw Hill, 2nd Edition.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-511-T	Transportation Engineering Lab	0-0-2	2	30	20	50	3 hours

- Penetration Ratio and Penetration Viscosity Number of Bituminous binders
- 10% Fines Test for aggregates
- Moisture sensitivity test for bitumen adhesion
- Viscosity-Temperature relationships for bituminous binders
- Rheological properties of bituminous binders
- Design of Bituminous mixes

## Semester Second

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CE-504-T	Analysis & Structural Design of Pavement	3-1-0	4	60	40	100	3 hours

**Unit 1:** General Consideration: Components of road pavement such as subgrade, Sub base, Base course and wearing course and their functions. Comparison of flexible and rigid pavements highway and airport pavements

**Unit 2.** Pavements Materials: Stabilizing base viz., Mechanical, Stabilized with admixture like cements, Bitumen lime and other chemicals. Factor Affecting the Pavements Design: Traffic factor, Moisture and climate factors, and Soil factor, Stress distribution factor Design of Flexible pavements:

**Unit 3.** General classification of various methods and their approach, Empirical methods using soil classification. Theoretical and semi theoretical methods. General observation and limitation of various methods.

**Unit 4.** Design Method of Rigid Pavements: Analysis of stresses in concrete pavements due to various wheel loads. Cyclic changes in temperature. Changes in moisture and volumetric change in subgrade and base course. Comparison of analysis of stress due to wheel loads on liquid and solids subgrade theorem. Thickness design methods such as P.C. A. design method F.A.A. methods etc. Design of distributed steel reinforcement, design of dowels, Design of spacing of joints.

**Unit 5. Pavement Evaluation and Strengthening:** Method of pavement evaluation including LCN method for airport, Design of various types of overlays for flexible and rigid pavements, Mechanics of pumping and blowing, Factor affecting pumping, preventive measures. Pavements Performance: Pavements performance, Road Mechanic and their applications, The AASHO road test. Evaluation of performance of the flexible and rigid pavements. Analysis of results from flexible and rigid pavements.

### Suggested Readings:

1. S.K.Khurana, Principles, Practice and Design of Highway Engineering,
2. E.J.Yodar and M.W.Witczac, Principles of Pavement Design, 2nd Edition, John Wiley and Sons, New York.
3. C.A. O'Flaherty, Highways, Butterworth Heinemann. 4. Khanna and Justo, Highway Engineering, Nem Chand & Bros. Roorkee.

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CE-506-T	Mass Transit System	3-1-0	4	60	40	100	3 hours

**Unit-1** Transportation System Management: Travel Demand management, Traffic Management, The problems caused by turning traffic, Advantage and dis-advantage of one way street working, Tidal flow operation, Closing side streets advantages & dis-advantages, BRT (Bus Rapid Transit)

**Unit-2** Trip Interchanges: Graded-separated intersections with or without interchange, Three leg interchange, Four leg interchange, Multi-leg interchange, Trumpet interchange, Diamond interchange, Clover leaf interchange, Rotary interchange, Interchange ramp, Loop, outer connection, Direct connection, Design speed for ramps.

**Unit-3** Transport Planning Process: Scope, Interdependence of land use and Traffic, Stages in Transport planning, Survey and analysis of existing conditions, Fore-cast analysis of future condition, Evaluation, Program adoption and implementation, Continuing study, Trip Distribution, Opportunity Model

**Unit-4** Urban Transportation Problem: Growth of Towns, Growth of Traffic, Nature of present difficulties in urban traffic conditions, Measures to meet the problems, New Transportation study, Traffic restraint measures, Promotion of public transport, Pedestrianisation, Staggering of office Hours, Promotion of Bi-cycle traffic, Role of Public transport, Fare and subsidies.

**Unit-5** Intermediate Public Transport (IPT) vehicles: Types of IPT, Characteristics of IPT modes, Traffic & Environment: Introduction, Detrimental effects of Traffic on Environment, Safety, Noise, Air pollution, Visual Intrusion, Severance. Factors affecting Fuel consumption of Motor vehicles: vehicle, Drive, Road, Fuel characteristics and environmental conditions, Measures for economy of fuel in road transport. Public-private partnership in Transport Projects: Benefits from privatization, Forms of privatization, BOT, Annuity Project, Special Purpose Vehicle (SPV), Design Build finance & Operate (DBFO)

#### **Suggested Readings;**

1. L.R.Kadiyali, Transport Engineering and Transport Planning, Eighth Edition 2013.
2. C.S. Papacostas, P.D.Prevedouros, Transport Engineering and Planning, PHI Publication, #rd Edition 2002

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CE-508-T	Transportation & Environment	3-1-0	4	60	40	100	3 hours

**Unit :1** Functioning of Governing Bodies e.g. Ministry of Environment & Forest, Central Pollution Control Board, State Pollution Control Board in coordination with Public & Private Sectors (Industrial Units). Planning and Decision making, Setting of industries and Concept of Zoning Atlas, Different Norms & Pollution Standards for disposal of Pollutants.

**Unit:2** Industrial Pollution & Abatement, Water/Sewage Treatment, Planning and laying of Sewers for Domestic & Industrial Effluent, Rainwater. Collection of Sewage, Systems of sewerage, separate, combined and partially separate. Construction, testing and maintenance of sewer lines. Water Distribution Network, analysis of distribution network, leakage detection, Maintenance.

**Unit:3** Environmental & Atmospheric Conditions, Different sources (i.e. Natural, Domestic, Industrial and Transport related Activities) of Air Pollution and its effects on surroundings. Dispersion of Air Pollutants in the atmosphere, Vehicular Pollution, analysis and measurement of vehicular emissions.Noise Pollution Different Sources, Standards and Preventing Practices.

**Unit:4** Natural Resources (e.g. soil, rocks, minerals surface water and ground water etc.) and its effect on Environment, Utilization and disposal of waste materials (e.g. Fly ash, wastewater etc) for conservation of natural resources.

**Unit:5** Environmental Management, Solid Waste Management, Study of Environmental Hazard, Multidisciplinary environmental strategies, Environmental Audit (EA), Risk Assessment (RA), Mass Balance related to Production and Generation of waste.Environmental Impact Assessment (Industrial as well as different mode of Transportation e.g. Highways, Railways and Airports etc), Conceptual information and methodologies for assessment of Environmental Hazard, Collection of baseline data, initial environmental examination (IEE), Environmental Impact Assessment (EIA) Planning and Execution of Projects, Resettlement Plans (Short Term & Permanent Resettlement) during and after site selection for Roads, Railways and Airports. Activities related to Planning and Implications.

#### **Suggested Readings;**

1. R.K. Sapru., "Environment Management in India", APH Publishing Corporations, 1990.
2. Garg, S.K., "Sewage and Sewage Treatment", Khanna Publishers, New Delhi, 1994.
3. B.C. Punmia., Ashok, Jain & Arun, Jain., "Water Supply Engineering", Laxmi Publication, New Delhi , 1995
4. Environmental Protection Act 1986 (Air, Water, Wastewater, Noise, Soil and Industrial Effluent)
5. Bindu, N. Lohani., "Environmental Quality Management", Publisher South Asian, 1984.
6. R.B. Singh., "Studies in Environment and Development" Commonwealth Publishers, 1988.
7. Larry W. Canter, Environmental Impact Assessment by Larry W. Canter.
8. Saxena, K.D., "Environmental Planning Policies and Programmes in India," Shipra Publication,1993.
9. Sharma, P. D., "Ecology and Environment", Rastogi Publication, 2009.
10. Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.
11. Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi.
12. E.W. Steel., "Water Supply and Sewerage", McGraw Hill, New Delhi.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-522-T	Traffic & Transportation Engineering Laboratory / Case Study	3-1-0	4	30	20	50	3 hours

- Traffic volume studies
- Spot speed studies
- Accident and Parking studies
- Design of Traffic rotaries and Intersections
- Traffic simulation modelling
- Road safety audit
- Use of software for geometric design and alignment of highway

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CE-526-T	Minor Project	0-0-4	2	30	20	50	3 hours

## Semester III

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CE-601-T	Airport, Docks & Harbour	3-1-0	4	60	40	100	3 hours

**Unit 1:** Classification of Airports Development of Air Transportation in India, Airport site election. Modern aircraft's.

**Unit 2:** Airport obstructions: Zoning Laws, Imaginary surfaces, Approach and Turning zone, clear zone, vert. Clearance for Highway & Railway.

**Unit: 3** Runway and taxiway design: Windrose, cross wind component, Runway Orientation and configuration. Basic runway length and corrections, runway geometric design standards. Taxiway Layout and geometric design standards. Taxiway and other areas.

**Unit: 4** Air traffic control: Need, Network, control aids, Instrumental landing systems Ports and

**Unit: 5** Harbours: Importance of ports and harbours. Impact on Indian trade and economy, Plan of harbour, various components, jetty, dolphins, bollards, their design and functions.

Suggested Readings:

1. Airport Planning & Design, Goyal & Praveen Kumar, Galgotia Publication
2. Harbour, Dock And Tunnel Engineering, R. Srinivasan, Charoter publishing house.



## Detailed Syllabus of Departmental Electives

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CE-507-T	Engineering Geology	4-0-0	4	60	40	100	3 hours

### Unit I

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

### Unit II

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

### Unit III

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.

### Unit IV

Landslides; Causes, Factors and corrective/Preventive measures.

### Unit V

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

### SUGGESTED READINGS:

1. Krynin, D.P. and Judd W.R. 1957. Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).
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 (3rd Edn.) 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	Theory	Internal Assessment	Total	Duration
CE-512-T	Construction Materials	3-1-0	4	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 HighPerformance Concrete, Applications of Fibre, Reinforced Concrete, Selfcompacting 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 aluminiumand 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 andGeo-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	Internal Assessment	Total	Duration
CE-611-T	Departmental Elective III (Bridge Engineering)	3-1-0	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



**DEPARTMENT OF CIVIL ENGINEERING  
(DCE)**

**Course of Study**

**Master of Technology (M.Tech)  
Civil Engineering (CE)  
(Construction Technology & Management)**

**Lingaya's Vidyapeeth, Faridabad**

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## M. Tech (Construction Technology & Management)

1 <sup>st</sup> Year SEMESTER – I					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CEC-501	Quantitative Methods in Construction Management	3-1-0	4
2	PCC	CEC-503	Building Science	3-1-0	4
3	PCC	CEC-505	Construction Project Management	3-1-0	4
4	PCC	CEC-511	Departmental Elective – I (Composite Materials)	3-1-0	4
5	PEC	CEC-551	Project Management Lab	0-0-4	2
6	PCC	CEC-553	Seminar on Construction Technology & Management	0-0-4	2
				<b>12-4-8</b>	<b>20</b>

1 <sup>st</sup> Year SEMESTER – II					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CEC-502	Construction Economics & Finance	3-1-0	4
2	PCC	CEC-504	Construction Practices & Equipment	3-1-0	4
3	PCC	CEC-506	Advanced Concrete Technology	3-1-0	4
4	PEC	CEC-512	Departmental Elective II (Construction Materials)	3-1-0	4
5	PEC	CEC-552	Advanced Concrete Technology Lab	0-0-4	2
6	PCC	CEC-554	Minor Project	0-0-4	2
				<b>12-4-8</b>	<b>20</b>

## M. Tech (Construction Technology & Management)

2 <sup>nd</sup> Year SEMESTER – III					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CEC-601	Construction Contract Management	3-1-0	4
2	PEC	CEC-611	Departmental Elective III (Construction and Maintenance Management)	3-1-0	4
3	PCC	CEC-651	Dissertation Work-I	0-0-12	6
4	PCC	CEC-653	Seminar-I	0-0-8	4
				<b>6-2-20</b>	<b>18</b>

2 <sup>nd</sup> Year SEMESTER – IV					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CEC-652	Seminar – II	0-0-8	4
2	PCC	CEC-654	Dissertation Work-II	0-0-24	12
3	PCC	CEC-656	Teaching Practice	0-0-8	4
				<b>0-0-40</b>	<b>20</b>



## List of Departmental Electives

Departmental Elective – I		
S. No.	Subject Code	Subject Name
1.	CEC-511	Composite Materials
Departmental Elective - II		
1.	CEC-512	Construction Materials
Departmental Elective - III		
1.	CEC-611	Construction & Maintenance Management

# 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-I 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
<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Introduction</li><li>• Literature Survey</li><li>• References</li></ul>	<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Introduction</li><li>• Literature Survey</li><li>• Methodology</li><li>• Modules Split-up and Gantt Chart</li><li>• Proposed System (Phase 1)</li><li>• Equations /Design and software to be used</li><li>• Algorithms / Techniques used</li><li>• Expected outcomes</li></ul>



## Dissertation Evaluation Form

### M.Tech – DW-I

### III Semester

**Dissertation Title : FIRST REVIEW**

Candidate Details			
Sl. No	University Register/ Roll No.	Candidate Name	Teacher
Candidate Contribution and Performance			
Subject Matter		Marks	
Understanding background and topic			
Specifies Dissertation goals			
Literature Survey			
Dissertation Planning			
Question and Answer			
Presentation skills			
<b>Total</b>			
<b>C o m m e n t s</b>			

**Member 1**

**Member 2**

**Member 3**

**HOD**



# Dissertation Evaluation Form

## M.Tech – DW-I

### III Semester

**Dissertation Title : SECOND REVIEW**

Candidate Details			
Sl.No	University Registration / Roll No	Candidate Name	Teacher

Candidate Contribution and Performance	
Subject Matter	Marks
Abstract	
Specifies Dissertation goals	
Literature Survey	
Summaries algorithms and highlights the Dissertation features	
Specifies the testing platforms and benchmark systems	
Dissertation Planning	
Technical Design	
Summarises the ultimate findings of the Dissertation	
Implementation (60 Percentage)	
Question and Answer	
Presentation skills	
<b>Total</b>	
<b>C o m m e n t s</b>	

**Member 1**

**Member 2**

**Member 3**

**HOD**



## 1.12 Dissertation Work-II Requirements: M.Tech.

First Review Within 4 Weeks	Second Review Within 16 Weeks
<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Work completed for Phase I</li><li>• Expected outcomes</li><li>• Draft copy of conceptual paper</li><li>• References</li></ul>	<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Work completed for Phase II</li><li>• Detailed Design (if any deviation)</li><li>• Contribution of the candidate</li><li>• Experimental Results</li><li>• Performance Evaluation</li><li>• Comparison with Existing system</li><li>• Result Analysis and Conclusion</li><li>• References</li><li>• Draft copy of a dissertation for publishing</li></ul>

### ***Note:***

- The presentation should have maximum of 30 slides
- Presentation will be for 30 minutes
- A draft copy of the conference paper to be prepared at the end based on the Dissertation Work.
- System to be tested using testing software's.



# Dissertation Evaluation Form

## M.Tech – DW-II

### IV Semester

**Dissertation Title: FIRST REVIEW**

Candidate Details			
Sl. No.	University Registration/ Roll No	Candidate Name	Teacher

Candidate Contribution and Performance	
Subject Matter	Marks
Abstract	
Work to be completed in Phase 1	
Architecture /System Design – Phase 1 and 2	
Work to be completed in Phase 2	
Summaries the techniques implemented / to be implemented	
Contribution of the Candidate	
Results obtained and Summaries the ultimate findings of the Dissertation	
Implementation (60 Percentage)	
Question and Answer	
Presentation skills	
<b>Total</b>	
<b>C o m m e n t s</b>	

**Member 1**

**Member 2**

**Member 3**

**HOD**



# Dissertation Evaluation Form

## M.Tech – DW-II

### IV Semester

**Dissertation Title: SECOND REVIEW**

Candidate Details			
Sl. No.	University Registration No	Candidate Name	Teacher

Candidate Contribution and Performance	
Subject Matter	Marks
Abstract	
Architecture /System Design – Phase 2	
Overall Architecture /System Design – Phase 2	
Summarises the techniques implemented	
Contribution of the Candidate	
Results obtained and Performance Evaluation	
Summarises the ultimate findings of the Dissertation	
Implementation (100 Percentage)	
Pre-final draft of entire dissertation	
Draft of the paper to be published	
Question and Answer	
Presentation skills	
<b>Total</b>	
<b>Comments</b>	

**Member 1**

**Member 2**

**Member 3**

**HOD**

## Detailed Contents

### Semester First

Course Code	Course Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CEC-501	Quantitative Methods in Construction Management	3-1-0	4	60	40	100	3 hr

Introduction and concepts of probability and statistics, Linear programming, Transportation and assignment problems. Dynamic programming, Queuing theory, Decision theory, Games theory. Simulations applied to construction, Modifications and improvement on CPM/PERT techniques.

#### Suggested Reading;

1. Operational Research by D.S. Heera

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CEC-503	Building Science	3-1-0	4	60	40	100	3 hours

Introduction to environmental features relevant to functional design. Their measures description and quantification. Periodic nature of variation of environmental descriptors. Heat exchange of building with environment under diurnal periodic variation temperature and modelling. Estimation of hourly internal temperature through CIBS method. Thermal Design philosophy and optimization for decision variables such as shape, orientation, envelope properties etc. Purpose of ventilation, wind and stack effect as driving force. Design for desired flow and indoor velocity. Fundamentals of acoustics, Sound ion free field and enclosure. External and Internal air borne noise control. Protection against structure borne noise. Lighting principles and daylighting. Day light factor, and design for desired illumination and glare free lighting.

#### Suggested Readings:

- 1.

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CEC-505	Construction Project Management	3-1-0	4	60	40	100	3 hr

### Unit I

Project Management: Basic forms of organization with emphasis on Project; Project life cycle, planning for achieving time, cost, quality, project feasibility reports based on socio-techno-economic-environmental impact analysis, project clearance procedures and necessary documentation for major works like dams, multi-storeyed structures, ports, tunnels, Qualities, role and responsibilities of project Manager, Role of Project Management Consultants, Web based project management.

### Unit II

Project Scheduling: Construction Scheduling, Work break down structure, activity cost and time estimation in CPM, PERT, techniques, Precedence Network Analysis.

### Unit III

Project Controlling: Monitoring and Control, Crashing, Resource Levelling, Updating. Work Study: Definition, Objectives, and basic procedure, and method study and work measurement.

### Unit IV

Work-study applications in Civil Engineering. Method study – Definition, Objective, Procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, string diagrams.

### Unit V

Work measurement – Time and motion studies, Concept of standard time and various allowances, time study, equipment performance rating.

### Suggested Readings;

- 1 Construction Planning & management By P S Gahlot & B M Dhir, New Age International Limited Publishers
2. Construction Project planning & Scheduling By Charles Patrick, Pearson, 2012
- 3 Construction Project Management Theory & practice --- Kumar Neeraj Jha, Pearson, 2012
4. Construction management Fundamentals by Knutson, Schexnayder, Fiori, Mayo, Tata McGraw Hill, 2nd Edition.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CEC-551	<b>Project Management Lab</b>	0-0-4	2	30	20	50	3 hours

Introduction to construction project models - analytical and numerical. Application software for project planning, scheduling & control (Primavera Software). Programming exercises for estimation, network planning and control, LP in construction. MATLAB Programming in linear and non-linear programming.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CEC-553	<b>Seminar on Construction Technology &amp; Management</b>	0-0-4	2	30	20	50	3 hours

Presentation based seminar in recent advancements in Construction Technology & Management. (Case Studies, Technology advancements, etc.)

## Semester Second

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CEC-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.

### Suggested Readings:

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CEC-504	Construction Practices & Equipment	3-1-0	4	60	40	100	3 hours

Form work design and scaffolding, slipform and other moving forms, Shoring, Reshoring, and Backshoring in multistoreyed Building construction. Prestressing, Steel and composites construction methods: Fabrication and erection of structures including heavy structures, Prefab construction, Industrialized construction, Modular coordination. Special construction methods: High rise construction, Bridge construction including segmental construction, incremental construction and push launching techniques. Factors affecting selection of equipment - technical and economic, Analysis of production outputs and costs, Characteristics and performances of equipment for major civil engineering activities such as Earth moving, erection, material transport, pile driving, Dewatering, and Concreting.

### Suggested Readings:

- 1.

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CEC-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.

#### **Suggested Readings;**

#### **3. Concrete Technology by Nebille**

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CEC-552	Advanced Concrete Technology Lab	0-0-4	2	30	20	100	3 hours

#### **Suggested Readings;**

#### **13. Concrete Technology by Nebille**

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CEC-554	Minor Project	3-1-0	4	30	20	50	3 hours



## Semester III

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CEC-601	Construction Contract Management	3-1-0	4	60	40	100	3 hours

Professional Ethics, Duties and Responsibilities of Parties. Owner's and contractor's estimate, Bidding Models and Bidding Strategies, Qualification of Bidders. Tendering and Contractual procedures, Indian Contract Act 1872, Definition of Contract and its Applicability, Types of Contracts, Clauses in Domestic and International Contracts - CPWD, MES, FIDIC, AIA, NEC, JCT, etc. Contract Administration, Delay Protocol, Change Orders Analysis, Claim Management and Compensation, Disputes and Resolution Techniques, Arbitration and Conciliation Act 1996, Arbitration Case Studies.

Suggested Readings:

1.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CEC-651	Dissertation Work-I	0-0-12	6	30	20	100	3 hours

M. Tech thesis part 1.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CEC-653	Seminar-I	0-0-8	4	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
CEC-652	Seminar-II	0-0-8	4	30	20	50	3 hours

Seminar on Dissertation Work-II.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CEC-654	Dissertation Work-II	0-0-12	6	30	20	100	3 hours

M. Tech thesis part 1.

Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CEC-656	Teaching Practice	0-0-8	4	30	20	50	3 hours

## Detailed Syllabus of Departmental Electives

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CEC-511	Departmental Elective III (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. Neville
2. Concrete Technology-M.L. Gambhir.

Subject Code	Subject Name	L-T-P	Cr	Theory	Internal Assessment	Total	Duration
CEC-512	Departmental Elective III (Construction Materials)	3-1-0	4	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	Internal Assessment	Total	Duration
CEC-611	Departmental Elective III (Construction & 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 efficiency, 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.



**DEPARTMENT OF CIVIL ENGINEERING  
(DCE)**

**Course of Study**

**Master of Technology (M.Tech)  
Civil Engineering (CE)  
(Environmental Engineering)**

**Lingaya's Vidyapeeth, Faridabad**

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## M.Tech (Environmental Engineering)

1 <sup>st</sup> Year SEMESTER – I					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CEE-501	Environmental Chemistry & Microbiology	3-1-0	4
2	PCC	CEE-503	Water & Wastewater Treatment Processes-I	3-1-0	4
3	PCC	CEE-505	Advance Water Supply & Wastewater Management	3-1-0	4
4	PEC	CEE-507	Hazardous Waste Management (Departmental Elective-I)	3-1-0	4
5	PCC	CEE-509	Special Lab Assignment-I	0-0-2	2
				<b>12-4-2</b>	<b>18</b>

1 <sup>st</sup> Year SEMESTER – II					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CEE-502	Water and Wastewater Treatment Technologies-II	3-1-0	4
2	PCC	CEE-504	Air Pollution & Control	3-1-0	4
3	PCC	CEE-506	Solid Waste Management	3-1-0	4
4	PEC	CEE-512	Environmental Safety and Management (Departmental Elective-II)	3-1-0	4
5	PCC	CEE-508	Special Lab Assignment-II	0-0-2	2
				<b>12-4-2</b>	<b>18</b>

## M.Tech (Environmental Engineering)

2 <sup>nd</sup> Year SEMESTER – III					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CEE-601	Environmental Impact Assessment	3-1-0	4
2	PCC	CEE-603	Industrial Impact Assessment	3-1-0	4
3	PEC	CEE-611	Climate change and Sustainable Development (DE-III)	3-1-0	4
4	PCC	CEE-621	Dissertation Work – I	0-0-12	6
5	PCC	CEE-623	Seminar - I	0-0-8	4
				<b>9-3-20</b>	<b>22</b>

2 <sup>nd</sup> Year SEMESTER – IV					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CEE-622	Seminars - II	0-0-8	4
2	PCC	CEE-624	Dissertation Work-II	0-0-24	12
3	PEC	CEE-626	Teaching Practice	0-0-8	4
				<b>0-0-40</b>	<b>20</b>

Departmental Electives-I		
S. No.	Subject Code	Subject Name
1.	CEE-507	Hazardous Waste Management
2.	CEE-509	Water Quality Management
3.	CEE-511	Environmental Planning & Management
Departmental Electives-II		
1	CEE-512	Environmental Safety and Management
2	CEE-514	Watershed Management
3	CEE-516	Industrial Environment Management Systems
Departmental Electives-III		
1	CEE -611	Climate Change and Sustainable Development
2	CEE-613	Environmental Legislation and Impact Assessment
3	CEE-615	Cleaner Technologies

# **Detailed Contents**

## **Semester First**

### **CEE-501 ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY**

1: **Types of chemical reactions** - calculations from chemical equations; gas laws; Equilibrium and Le Chatelier's Principle – factors affecting chemical equilibrium - activity and activity coefficient - ionic strength. Physical Chemistry:- Thermodynamics – heat and work – enthalpy – entropy – free energy – temperature dependence of equilibrium constant; membrane processes; principles of solvent extraction; ; electrochemistry; chemical kinetics; adsorption.

2 **Equilibrium Chemistry**:-Variations of Equilibrium relationships; ways of shifting chemical equilibrium; solutions to equilibrium problems - acid base equilibrium – solubility equilibrium – oxidation reduction equilibrium.

3. **Organic Chemistry And Biochemistry**:-Organic compounds of interest to environmental engineers, general properties of the functional groups of organic compounds; Enzymes, classification enzymes catalyzed reaction, energy considerations coupling of reaction; Breakdown and synthesis of carbohydrates, fats, proteins under aerobic and anaerobic reactions; CNP cycles under aerobic and anaerobic reactions;. Concepts of BOD, COD, TOC.

4. **Environmental Chemistry**:-Fundamentals of surface and colloidal chemistry; chemistry involved in water treatment procedure like coagulations – softening - fluoridation, defluoridation - iron and manganese removal – demineralization - analysis of pesticide and heavy metals; Atmospheric chemistry; soil chemistry

5. **Environmental Microbiology**:- Introduction of microbiology, classification and characterization of microorganisms, viruses; Morphology and structure of bacteria, nutrient requirement, growth of bacteria; Basic microbiology of water and sewage; Basic principals involved in the analysis of fecal indicator bacteria – coli forms and streptococci, plankton

## CEE-503 WATER AND WASTEWATER TREATMENT TECHNOLOGIES

1. **Water – Quality, Standards and Criteria:** Physical, chemical and biological water quality; Heavy metals and pesticide pollution; Water quality guidelines, criteria and standards.
2. **Water Treatment Technologies:** Treatment of surface waters and ground waters; Water treatment technologies overview; Water treatment plants producing drinking water, process water, soft water, RO water and DM water.
3. **Coagulation/Precipitation, Flocculation and Settling:** Coagulation-flocculation; Coagulants and flocculating agents; Flash mixing tanks, flocculation tanks, clari-flocculators and settling tanks.
4. **Filtration Systems:** Filtration theory and filter hydraulics; Slow sand filters; Rapid gravity filters; Pressure filters; and Multigrade roughing filters. Chlorination; Ozonation; Membrane processes for disinfection
5. **Other Water Treatment Technologies:** Ion-exchange process; Adsorption process; membrane processes (nanofiltration and reverse osmosis); Defluoridation units and household level water purification systems.

### **Recommended Books**

1. Metcalfe and Eddy Inc., Tchobanglous G, Burton FL, Stensel HD, *Wastewater Engineering – Treatment, Disposal and Reuse*, Tata McGraw Hill (2007).
2. Eckenfelder WW Jr, *Industrial Water Pollution Control*, McGraw Hill 3<sup>rd</sup> ed (2003).
3. Weber WJ, *Physico-chemical Processes for Water Quality Control*, John-Wiley (1999).
4. Tebbutt THY, *Principles of Water Quality Control*, Butter Worth Heinemann (1998)

## CEE 505 ADVANCE WATER SUPPLY & WASTEWATER MANAGEMENT

- 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).

## **CEE 507 HAZARDOUS WASTE MANAGEMENT**

**1. Solid and Hazardous Wastes:** Definition, sources and characteristics; Sampling and analysis techniques; Inventorying wastes; Strategies for waste minimization.

**2. Municipal Solid Waste Management:** Segregation and recycling and reuse of wastes; Collection, transportation and storage of municipal solid waste; Resource recovery from wastes; waste exchanges; Composting and vermi-composting of wastes; Municipal solid waste management programs; Disposal – siting and design.

**3. Hazardous Waste Treatment and Disposal:** Biological and chemical treatment of hazardous wastes; Solidification and stabilization of wastes; Incineration for the treatment and disposal of hazardous wastes;

**4. Land farming;** Landfill disposal of hazardous waste;

**5. Bioremediation** of hazardous waste disposal sites.

### **Recommended Books**

1. Pichtel J, Waste Management Practices: Municipal, Industrial and Hazardous, CRC Press (2005)
  2. Kreith F and Tchobanoglous G, Handbook of Solid Waste Management, McGraw Hill (2002)
  3. LaGrega M, Buckingham P and Evans J, Hazardous Waste Management, McGraw Hill (1994)
  4. Freeman H, Standard Handbook for Hazardous Waste Management, McGraw Hill (1989)
  5. Pollution Control Acts, Rules and Notifications Issued There under: Pollution Control Law Series, Central Pollution Control Board, New Delhi (1986)
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## SEMESTER II

### CEE-502: WATER AND WASTEWATER TREATMENT PROCESS-II

1. **Wastewater Characteristics and Effluent Standards:** Physical, chemical and biological parameters of water pollution; DO, BOD and BOD kinetics; Nutrients; Effluent standards.
2. **Overview of Wastewater Treatment Technologies:** Preliminary, primary, secondary and tertiary treatment technologies.
3. **Preliminary Treatment:** Screens; Grit removal facilities; Effluent sumps and pumps; and 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; Waste stabilization pond systems and its modifications.

**Other Treatment Technologies:** Advanced oxidation processes; Biological nutrient removal; Filtration and chlorination; Membrane processes for TDS reduction.

.

#### **Recommended Books**

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

### CEE-504 AIR POLLUTION NAD CONTROL

1. **Introduction:** Role and scope of air pollution control engineering, Principles of fluid flow, Boundary layer theory, Energy transfer in fluid flow, Fluid flow measurement, Dynamics of particles in fluid, Properties of particles, Collection efficiencies of particles, Source reduction (Fuel substitution, Fuel pretreatment, Process modifications), Emission standards.
2. **Design of Industrial Ventilation Systems:** Component of Ventilation systems, Air pollution control systems, Hood specifications and design, Duct specifications and design, Blowers, stacks.
3. **Particulate Emission Control:** Stoke's law, Basic principles, Design and operation of settling chambers (Both laminar and turbulent flow), Cyclone and multiclones, Scrubbers, Bag



houses and Electrostatic precipitators, Collection efficiency and Pressure drop calculations across air pollution control devices.

4. **Gaseous Emissions Control:** Basic principles, Design and operation of scrubbers for gaseous pollutant removal, Adsorption columns and condensation devices.
5. **Control of Mobile Sources:** Control of crank case emissions, Evaporative emissions control, Air fuel ratio, Alternative fuels, Automobile emission control, Catalytic convertors, Gasoline and diesel powered vehicles. **Air Pollution Mitigation Measures:** Green belt design, Management strategies for air pollution abatement

### **Recommended Books**

1. Flagan RC and Seinfeld JH, *Fundamentals of Air Pollution Engineering*, Prentice Hall (1988).
2. Boubel RW, Fox DL, Turner B and Stern AC, *Fundamental of Air Pollution*, Academic Press (1994). 3<sup>rd</sup> ed.
3. Perkins HC, *Air Pollution*, McGraw Hill (2004).
4. Rao CS, *Environmental Pollution Control Engineering*, New Age International (2006).
5. Rao MN and Rao HVN, *Air Pollution*, Tata McGraw Hill (2006). 2<sup>nd</sup> ed.

### **CEE: 506 SOLID WASTE MANAGEMENT**

**1 Solid and Hazardous Wastes:** Definition, sources and characteristics; Sampling and analysis techniques; Inventorying wastes; Strategies for waste minimization.

**2 Municipal Solid Waste Management:** Segregation and recycling and reuse of wastes; Collection, transportation and storage of municipal solid waste; Resource recovery from wastes; waste exchanges; Composting and vermi-composting of wastes; Disposal – siting and design.

**3. Hazardous Waste Treatment and Disposal:** Biological and chemical treatment of hazardous wastes; Solidification and stabilization of wastes; Incineration for the treatment and disposal of hazardous wastes; Landfill disposal of hazardous waste; Bioremediation of hazardous waste disposal sites.

**4. Special Waste Management:** Biomedical wastes, E-waste.

**5. Legal Requirements:** Municipal solid waste rules; Hazardous waste rules; Biomedical waste rules; E-waste rules; Rules related to recycled plastics, used batteries, flyash, etc.

### **Recommended Books**

1. *Pichtel J, Waste Management Practices: Municipal, Industrial and Hazardous, CRC Press (2005)*
2. *Kreith F and Tchobanoglous G, Handbook of Solid Waste Management, McGraw Hill (2002)*
3. *LaGrega M, Buckingham P and Evans J, Hazardous Waste Management, McGraw Hill (1994)*
4. *Freeman H, Standard Handbook for Hazardous Waste Management, McGraw Hill (1989)*
5. *Pollution Control Acts, Rules and Notifications Issued There under: Pollution Control Law Series, Central Pollution Control Board, New Delhi (1986)*

### **CE512: ENVIRINMENTAL SAFTY AND MNAGEMENT**

1. **Hazardous Materials:** Definition and classification; Material safety data sheets; Handling of hazardous materials.
  2. **Regulations:** Rules and regulations pertaining to the management and handling of hazardous chemicals; Hazardous wastes; Biomedical wastes; Hazardous microorganisms; Genetically engineered organisms or cells; Municipal solid wastes; E-wastes; Batteries and plastics.
  3. **Hazard Identification:** Assessment of risk; Risk management; OSHAS 18001 and Occupational health and safety management systems.
  4. **Principles of Accident Prevention:** Accident recording; Analysis; Investigation and reporting; On-site and off-site emergency preparedness and response plans; Rules and regulations dealing with chemical accidents.
  5. **Protection from Hazardous Materials:** Personal protective equipment and clothing; Fire safety; Noise and vibrations; Principles of noise control. **Safety Management:** Notification of sites; Safety reports; safety audits.
-

## SEMESTER 3

### CEE-601 ENVIRONMENTAL IMPACT ASSESSMENT

- 1. Introduction:** The Need for EIA, Indian Policies Requiring EIA , The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.
- 2. Identifying The Key Issues:** Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection: Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues.
- 3. EIA Methodologies:** Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods, Environmental index using factor analysis, Cost/benefit analysis, Predictive or Simulation methods. Rapid assessment of Pollution sources method, predictive models for impact assessment, Applications for RS and GIS.
- 4. Reviewing The EIA Report:** Scope, Baseline Conditions, Site and Process alternatives, Public hearing. Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality,
- 5. Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport System, Integrated Impact**

### CEE -603 INDUSTRIAL IMPACT ASSESSMENTS

- 1 Introduction:** Industrial systems; Resource consumption, waste generation and environmental pollution; Legal environmental requirements applicable to industrial facilities; Environmental functions of industrial facilities.
- 2. Environmental Aspects:** Process mapping approach for the identification of environmental aspects of industrial activities; Core industrial activities and environmental aspects; Support industrial activities and environmental aspects; Significant environmental aspects.
- 3. Management of Environmental Aspects:** Waste minimization through source reduction; Waste recycling and reuse; By-products and resources recovery from wastes; Waste treatment and disposal; Overview of waste treatment technologies; pollution prevention programs.
- 4. Environmental Management System (EMS) Approach:** Basic concepts of EMS approach; Essential elements of an EMS and ISO 14001; ISO 14000 series of standards and their relevance to EMS and to the environmental performance improvement.
- 5. Development; Implementation and Maintenance of EMS:** EMS development and implementation project and plan; ISO 14004 standard; Identification of significant environmental aspects; Formulation of environmental policy and setting of environmental objectives and targets;

Environmental management programs; Operational controls .**EMS Auditing:** EMS auditing; and audit program and procedures; ISO 19011 and environmental auditing; Audit activities and audit reports.

### **Recommended Books**

1. Freeman H, *Industrial Pollution Prevention Handbook*; McGraw-Hill Professional 1<sup>st</sup> Ed. (1994)
2. Edwards AJ, *ISO 14001: Environmental Certification Step by Step*; Butterworth-Heinemann (2004).
3. Stapleton PJ, Glover MA and Davis SP, *Environmental Management Systems: An Implementation Guide to Small and Medium-sized Industries*; NSF International 2<sup>nd</sup> ed. (2001)
4. *ISO 14004: 2004 - Environmental management systems – General guidelines on principles; systems and support techniques.*
5. *ISO 19011: 2011- Guidelines for auditing management systems.*
6. *ISO 17021: 2011 - Conformity assessment — Requirements for bodies providing audit and certification of management systems.*

## **CEE-605 ENVIRONMENTAL GEOTECHNIQUES**

1. Soil Formation, Composition and Structure: Introduction, Soil formation, Solids composition and characterization, Mineral composition, Different scales of soil structure, Structural variations due to consolidation and compaction, Pore sizes associated with soil structure, single particle arrangements, Role of Composition and soil structure in the engineering behavior of soils.
  2. Mass Transport and Transfer in Soils: Introduction; Mass transport mechanisms, Mass transfer mechanisms, Governing equation for mass transport, Solutions for special cases of mass transport.
  3. Non-aqueous – Phase Liquids in Soils: Introduction, Principles of NAPL entrapment in soils, Conceptualization of field-scale transport of NAPLs, phase diagram for soil – water – LNAPL – Air systems, Mobilization of residual NAPLs.
  4. Site Investigation: Introduction, Site investigation approach, phase investigations, Geophysical techniques, Hydro-geological investigations, Hydro-geochemical investigations, Geochemical data collection and analysis.
  5. Principles of Site and Geo-material Treatment Techniques: Treatment approaches, Basis for treatment technology selection, Pump and treat principles, In-situ soil flushing, In-situ vitrification principles, In-situ chemical treatment in reactive walls, Natural attenuation principles, In-situ phytoremediation and In-situ bioremediation principles, Ex-situ solidification/stabilization principles and Ex-situ chemical treatment principles.
- Waste Containment System: Landfills, Slurry walls, Drainage trenches and wells,

Surface Impoundments, Grout curtains, Composite systems.

#### **Recommended Books:**

1. Mitchell, J.K. and Soga, K., Fundamentals of Soil Behaviour, John Wiley & Sons, Inc., New Jersey., 2005
2. Reddy, L.N. and Inyang. H. I., Geoenvironmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000
3. Mohamed, A.M.O. and Antia, H.E., Geoenvironmental Engineering, Elsevier, Netherlands., 1998
4. Hsai\_Yang Fang and Daniels, J.L. Introductory Geotechnical Engineering an Environmental Perspective, Taylor & Francis, Oxon., 2006
5. Yong, R. N., Geoenvironmental Engineering: Contaminated Soils, Pollutant Fate and Mitigation”, CRC press LLC, Florida., 2001

#### **CEE-611: CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT**

1. **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, Kleindorfer P. R. et. al (ed.), Edward Elgar, 1996
5. Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007



**DEPARTMENT OF CIVIL ENGINEERING  
(DCE)**

**Course of Study**

**Master of Technology (M.Tech)  
Civil Engineering (CE)  
(Structural Engineering)**

**Lingaya's Vidyapeeth, Faridabad**

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## M. Tech (Structural Engineering)

1 <sup>st</sup> Year SEMESTER – I					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CES-501	Advanced Structural Engineering	3-1-0	4
2	PCC	CES-503	Advanced RCC Design	3-1-0	4
3	PCC	CES-505	Structural Dynamics	3-1-0	4
4	PEC	CES-511	Departmental Elective-I (Composite Materials)	3-1-0	4
5	PCC	CES-521	Advanced Material Testing Lab	0-0-4	2
				<b>12-4-4</b>	<b>18</b>

1 <sup>st</sup> Year SEMESTER – II					
SN	Category	Course Code	Course Name	Periods	Cr.
				L-T-P	
1	PCC	CES-502	Design of Bridges	3-1-0	4
2	PCC	CES-504	Advanced Design of Steel Structures	3-1-0	4
3	PCC	CES-506	Finite Elements Method in Structural Engineering	3-1-0	4
4	PEC	CES-512	Departmental Elective-II (Advanced Engineering Geology)	3-1-0	4
5	PCC	CES-522	Computational Lab for Structural Engineering	0-0-4	2
				<b>12-4-4</b>	<b>18</b>

## M. Tech (Structural Engineering)

<b>2<sup>nd</sup> Year SEMESTER – III</b>					
<b>SN</b>	<b>Category</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Periods</b>	<b>Cr.</b>
				<b>L-T-P</b>	
1	PCC	CES-601	Earthquake Analysis & Design of Structures	3-1-0	4
2	PCC	CES-611	Departmental Elective III (Construction and Maintenance Management)	3-1-0	4
3	PCC	CES-621	Dissertation Work–I	0-0-12	6
4	PEC	CES-623	Seminar - I	0-0-12	6
				<b>6-2-24</b>	<b>20</b>

<b>2<sup>nd</sup> Year SEMESTER – IV</b>					
<b>SN</b>	<b>Category</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Periods</b>	<b>Cr.</b>
				<b>L-T-P</b>	
1	PCC	CES-622	Seminars - II	0-0-8	4
2	PCC	CES-624	Teaching Practice	0-0-8	4
3	PCC	CES-626	Dissertation Work -II	0-0-24	12
				<b>0-0-40</b>	<b>20</b>

## Departmental Electives

Departmental Elective – I		
S. No.	Subject Code	Subject Name
1.	CES-511	Composite Materials
2.	CES-513	Design of Pre-Stressed Concrete Structures
3.	CES-515	High Rise Buildings
Departmental Elective – II		
1.	CES-512	Advanced Engineering Geology
2.	CES-514	Stability Theory in Structural Engineering
3.	CES-516	Rehabilitation of Structures
Departmental Elective – III		
1.	CES-611	Construction and Maintenance Management
2.	CES-613	Advanced Numerical Analysis

# 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-I 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
<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Introduction</li><li>• Literature Survey</li><li>• References</li></ul>	<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Introduction</li><li>• Literature Survey</li><li>• Methodology</li><li>• Modules Split-up and Gantt Chart</li><li>• Proposed System (Phase 1)</li><li>• Equations /Design and software to be used</li><li>• Algorithms / Techniques used</li><li>• Expected outcomes</li></ul>





## Dissertation Evaluation Form

### M.Tech – DW-I

### III Semester

**Dissertation Title : FIRST REVIEW**

<b>Candidate Details</b>			
Sl. No	University Register/ Roll No.	Candidate Name	Teacher
<b>Candidate Contribution and Performance</b>			
Subject Matter		Marks	
Understanding background and topic			
Specifies Dissertation goals			
Literature Survey			
Dissertation Planning			
Question and Answer			
Presentation skills			
<b>Total</b>			
<b>C o m m e n t s</b>			

**Member 1**

**Member 2**

**Member 3**

**HOD**

# Dissertation Evaluation Form

## M.Tech – DW-I

### III Semester

**Dissertation Title : SECOND REVIEW**

<b>Candidate Details</b>			
Sl.No	University Registration / Roll No	Candidate Name	Teacher
<b>Candidate Contribution and Performance</b>			
<b>Subject Matter</b>			<b>Marks</b>
Abstract			
Specifies Dissertation goals			
Literature Survey			
Summaries algorithms and highlights the Dissertation features			
Specifies the testing platforms and benchmark systems			
Dissertation Planning			
Technical Design			
Summarises the ultimate findings of the Dissertation			
Implementation (60 Percentage)			
Question and Answer			
Presentation skills			
<b>Total</b>			
<b>C o m m e n t s</b>			

**Member 1**

**Member 2**

**Member 3**

**HOD**

## 1.12 Dissertation Work-II Requirements: M.Tech.

First Review Within 4 Weeks	Second Review Within 16 Weeks
<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Work completed for Phase I</li><li>• Expected outcomes</li><li>• Draft copy of conceptual paper</li><li>• References</li></ul>	<ul style="list-style-type: none"><li>• Title</li><li>• Abstract</li><li>• Work completed for Phase II</li><li>• Detailed Design (if any deviation)</li><li>• Contribution of the candidate</li><li>• Experimental Results</li><li>• Performance Evaluation</li><li>• Comparison with Existing system</li><li>• Result Analysis and Conclusion</li><li>• References</li><li>• Draft copy of a dissertation for publishing</li></ul>

### **Note:**

- The presentation should have maximum of 30 slides
- Presentation will be for 30 minutes
- A draft copy of the conference paper to be prepared at the end based on the Dissertation Work.
- System to be tested using testing software's.

# Dissertation Evaluation Form

## M.Tech – DW-II

### IV Semester

**Dissertation Title: FIRST REVIEW**

Candidate Details			
Sl. No.	University Registration/ Roll No	Candidate Name	Teacher

Candidate Contribution and Performance	
Subject Matter	Marks
Abstract	
Work to be completed in Phase 1	
Architecture /System Design – Phase 1 and 2	
Work to be completed in Phase 2	
Summaries the techniques implemented / to be implemented	
Contribution of the Candidate	
Results obtained and Summaries the ultimate findings of the Dissertation	
Implementation (60 Percentage)	
Question and Answer	
Presentation skills	
<b>Total</b>	
<b>C o m m e n t s</b>	

**Member 1**

**Member 2**

**Member 3**

**HOD**

# Dissertation Evaluation Form

## M.Tech – DW-II

### IV Semester

**Dissertation Title: SECOND REVIEW**

Candidate Details			
Sl. No.	University Registration No	Candidate Name	Teacher

Candidate Contribution and Performance	
Subject Matter	Marks
Abstract	
Architecture /System Design – Phase 2	
Overall Architecture /System Design – Phase 2	
Summarises the techniques implemented	
Contribution of the Candidate	
Results obtained and Performance Evaluation	
Summarises the ultimate findings of the Dissertation	
Implementation (100 Percentage)	
Pre-final draft of entire dissertation	
Draft of the paper to be published	
Question and Answer	
Presentation skills	
<b>Total</b>	
<b>Comments</b>	

**Member 1**

**Member 2**

**Member 3**

**HOD**

## Detailed Contents of Syllabus Semester First

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-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 bounds, Plastic analysis of beams and multi-storey frames using mechanism method.
- 6. Non Linear Analysis:** Introduction to geometric and material non-linearity.
  1. Przemieniecki, J.S., 'Theory of Matrix Structure Analysis', Tata McGraw Hill Book Co.
  2. Martin, H.C. 'Introduction to Matrix Methods of Structural Analysis' McGraw Hill Book Co.
  3. Meghre & Deshmukh, 'Matrix Methods of Structural Analysis' Charotar Publishing House, Anand.
  4. Pandit & Gupta, Matrix Analysis of Structures, Tata McGraw Hill Publications (2003). Iyengar, N.G.R., Elastic Stability of Structural Elements, Macmillan India Ltd (1980).
  5. Gere, G. M. and Weaver, Jr. W., Matrix Analysis of Framed Structures, CBS Publishers (1987).
  6. McCormac, J. C. & Nelson, J. K., Structural Analysis: A Classical and Matrix Approach, John Wiley and Sons (1997).

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-503	Advanced RCC Design	3-1-0	4	60	40	100	3 hours

- 1. Yield Line Theory:** Assumptions, location of yield lines, methods of analysis, analysis of one way and two way slabs.
- 2. Flat slab:** Limitations of Direct Design Method, shear in flat slabs, equivalent frame method, opening in flat slabs.
- 3. Redistribution of moments in beam:** conditions for moment redistribution, single span beams, multi-span beams and design of sections.
- 4. Deep Beam:** minimum thickness, design by IS-456. Design as per British and American practice, beam with holes.
- 5. Shear walls:** classification of shear wall, classification according to behavior and design of rectangular and flanged shear wall.
- 6. Cast-in-situ Beam-column joint,** Force acting on joints, strength requirement of column, anchorage, confinement of core, shear strength of joint, corner joint and procedure for design.
- 7. Computation of deflection and crack-width:** short term and long term deflection of beam and slab, calculation of deflection as per IS-456, Factors effecting crack width in beams, calculation of crack width in beams, calculation of crack width as per IS-456, shrinkage and thermal cracking.

Books recommended:

1. Varghese, P.C. (2001), 'Advanced Reinforced Concrete Design', Prentice Hall of India, New Delhi.
2. Jain, A.K. (1999), 'Reinforced Concrete Limit State Design' Nem Chand & Bros, Roorkee.
3. Krishna Raju (1986), 'Advanced Reinforced Concrete Design', C.B.S. Publication, New Delhi.
4. Ferguson P.M., Breen J.E. and Jirsa J.O. (1988), 'Reinforced Concrete Fundamentals', Johan wiley & sons, New York.

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-505	Structural Dynamics	3-1-0	4	60	40	100	3 hours

1. **Introduction:** Objective, difference between static and dynamic analysis, loading, essential characteristics of a dynamic problem, principles of dynamics, formulation of equation of motion.
2. **Single Degree Of Freedom System:** analysis for free and forced vibration, Duhamels integral, Damping – types and evaluation, Response of SDOF system to harmonic excitation, Periodic excitation, Impulsive loading, arbitrary, step, pulse excitation, Response to General Dynamic loading, Numerical evaluation of dynamic response-superposition and step by step methods, generalized SDOF system.
3. **Multi degree of freedom:** equation of motion, equation of structural property matrices, problem statement and solution methods, free vibration, forced harmonic vibration, damped motion for MDOF, Generalized co-ordinates, principle of orthogonality of modes, Eigenvalue problem, model response, approximate methods: Stodalla-Vanaello, Modified Reyleigh's method, Holzer's Method, Holzer Myklested method, Matrix method, Energy method, Lagrange's equation, model analysis, stochastic response of linier SDOF and MDOF system to Gaussian inputs.

#### Books recommended:

1. Clough and Penzien, 'Dynamics of Structures' McGraw Hill Book co.
2. Chopra, A.K., 'Dynamics of Structures', Theory and Application to Earthquake Engineering', Prentice Hall of India, New Delhi. 1995.
3. Glen V. Berg, 'Element of Structural Dynamic', Prentice Hall, Engewood Cliffs, NJ.
4. Grover L. Rogers, 'Dynamics of Framed Structures', John Wiley and Sons Inc., New York.



Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CES-521	Advanced Material Testing Lab	0-0-4	2	30	20	50	3 hours

### **List of experiments/assignments**

1. Concrete Mix Design as per IS-10262 for various grades of concrete mixes.
2. Special concretes.
3. Durability studies on concrete.
4. Effect of super plasticizer on properties of concrete in fresh and hardened stages.
5. Measurement of air content of concrete.
6. Fineness of cement by Air Permeability method.
7. Non Destructive Testing of Concrete.
8. To determine the modulus of elasticity of concrete.
9. Effect of replacement of fly ash on properties of concrete.
10. Testing of structural steel reinforcement and steel sections.

## Semester Second

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-502	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.
7. **Foundations:** Types of foundations and general design criteria, design of well and  
Pile foundations for piers and abutments.

Books recommended:

- 1 Victor, D.J., 'Essential of bridge Engineering' Oxford & IBH Pub.Co
- 2 Rower, R.E., 'Concrete bridge Design' C.R. Books Ltd., London.
- 3 Krishna Raju, N., 'Design of bridges' Oxford & IBH Pub. Co., New Delhi.
- 4 Krishna Raju, N. 'Prestressed Concrete' Tata McGraw Hill, New Delhi.
- 5 Bakht, B and Jaeger, L.C., 'Bridge Analysis Simplified' McGraw Hill Int. Ed., New Delhi.

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-504	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.

Books recommended:

- 1 Teaching resource for Structural Steel Design Vol. 1 to 3, Institute for steel development & growth (INSDAG), Calcutta.
- 2 Morsis L.J., Plum, D.R "Structural Steel Work Design".
- 3 Yu, W.W., "Cold Formed Steel Structures Design".
- 4 Arya A.S. and Ajmani, J.L., "Design of Steel Structures".
- 5 Sihna D.A. "Design of Steel Structures".

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-506	Finite Elements Method in Structural Engineering	3-1-0	4	60	40	100	3 hours

**Introduction to Finite Elements:** Introduction, Direct formulation of finite element characteristics, Energy approach, Convergence criteria, Displacement functions with discontinuity between elements, Solution bounds, Extension of variational approach.

**Plane Stress and Plane Strain:** Introduction, Element characteristics, Assessment of accuracy, Some practical applications.

**Axis-Symmetric Stress Analysis:** Introduction, Element characteristics, Practical applications, Non-symmetrical loading.

**Some Improved Elements in 2-D Problems:** Introduction, Quadrilateral element, Characteristics derived from triangular elements, Conforming shape functions for a rectangle, Conforming shape functions for an arbitrary quadrilateral, Triangular element with size nodes.

**Nodes Dimensional Stress Analysis:** Introduction, Tetrahedral element characteristics, Composite elements with eight nodes, Improved displacement functions an element with eight arbitrary nodes, Tetrahedral element with ten nodes, Introduction to rectangular elements, Quadrilateral elements, Conforming functions for quadrilateral elements, Plate-bending elements, Introduction to non-linear Analysis-Material non-linearity and Performance non-linearity.

Books recommended:

1. Bhavikati S. S., "Finite Element Analysis" New Age International Publishers, New Delhi (2005)
2. Desai C. S. and Abel J. F.; Introduction To The Finite Element Method : A Numerical Method For Engineering Analysis, CBS Publisher (2005)
3. O.C. Zienkiewicz & R.L. Taylor, "The Finite element method", Butterworth Heinemann (Vol I and Vol II), ( 2000).
4. J. N. Reddy, An introduction to the finite element method, McGraw Hill Inc. (1993).
5. C.S. Krishnamoorthy, "Finite Element Analysis, Theory and programming", Tata McGraw Hill, (1994).



Subject Code	Subject Name	L-T-P	Cr	Internal Assessment	Practical	Total	Duration
CES-522	Computational Lab for Structural Engineering	0-0-4	2	30	20	50	3 hours

1. Analysis and design of Multi-storey building frames using STAAD. Pro., SAP, Ansys
2. Analysis and design of Elevated Water Tank using STAAD.Pro., SAP, Ansys
3. Analysis and design of bridge decks and other structures using STAAD.Pro., SAP, Ansys
4. Analysis and design of steel trusses using STAAD-Pro., SAP, Ansys
5. Dynamic response of structures using PULSE software.

Books recommended:

1. Software related manuals.

## Semester Third

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-601	Earthquake Analysis & Design of Structures	3-1-0	4	60	40	100	3 hours

- 1. Engineering Seismology:** Basic terms, seismic waves, earthquake magnitude and intensity, ground motion, dynamic response of structures, normalized response spectra, seismic coefficients and seismic zone coefficients.
- 2. Torsion and Rigidity:** Rigid diaphragms, torsional moment, centre of mass and centre of rigidity, torsional effects.
- 3. Lateral Analysis of Building Systems:** Lateral load distribution with rigid floor diaphragms, moment resisting frames, shear walls, lateral stiffness of shear walls, shear-wall frame combination, Examples.
- 4. Concept of Earthquake Resistant Design:** Objectives of seismic design, ductility, hysteric response & energy dissipation, response modification factor, design spectrum, capacity design, classification of structural system, IS codal provisions for seismic design of structures, multistoreyed buildings, design criteria, P- $\Delta$  effects, storey drift, design examples, ductile detailing of RCC structures.
- 5. Seismic Design of Special Structures:** Elevated liquid storage tanks, hydrodynamic pressure in tanks, stack like structures; IS-1893 codal provisions for bridges: Superstructure, sub-structure, submersible bridges.
- 6. Seismic Strengthening of Existing Buildings:** Seismic strengthening procedures.
- 7. Seismic Design of Brick Masonry Construction:** Shear walls and cross walls, opening in bearing walls, brick infills in Framed buildings, strengthening arrangements as per IS-4326, Design of bands.

Books recommended:

1. Chopra A.K., 'Dynamics of Structures- Theory & Applications to Earthquake Engineering' Prentice Hall, India.
2. Clough & Penzien, 'Dynamic of Structures' McGraw Hill Co.
3. Paz, M., 'International Handbook of Earthquake Engineering', Chapman & Hall, Newyork.
4. IS 1893-1984 Indian Standard Criteria for Earthquake Resistant Design of Structures, B.I.S., New Delhi.
5. IS 4326-1993 Indian Standard Code of Practice for Earthquake Resistant Design and Construction of Buildings, B.I.S., New Delhi.

## Detailed Syllabus of Departmental Electives

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-512	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	Theory	Sessional	Total	Duration
CES-513	Design of Pre-Stressed Concrete Structures	3-1-0	4	60	40	100	3 hours

1. **Prestressing System and Losses of Prestress:** Introduction, various systems of prestressing, types of losses and their analysis.
2. **Working Stress Design of Simple Beams:** Critical load conditions; allowable stresses; Flexural design criteria; axially prestressed members; design of prestressing cable for a given cross-section; design procedure based on flexure, design by load balancing method and multiple stage prestressing.
3. **Continuous Beams:** Analysis of two span beam, analysis of two span beam with eccentricities at outer supports; continuous beams with variable section; design of continuous beam.
4. **Limit State Design of Beams:** Limit state of strength in flexure, shear and torsion; permissible stresses, Limit state of serviceability against deflection, cracking and durability; Design of simply supported and continuous beams. Limit State Design of partially pre-stressed Beams, Moment Capacity of rectangular and flanged section; design for shear and serviceability.
5. **Bond and Anchorage of prestressing cables:** bond in pre-tensioned and post-tensioned construction, prestressing cable at centroidal axis; symmetric multiple cables causing axial thrust; cable eccentricity; inclined prestressing cable, spalling stresses, end zone reinforcement.

Books recommended:

1. N. Krishna Raju, Prestressed Concrete, Tata-McGraw Hill, Delhi.
2. P. Dayaratnam, prestressed Concrete Structures, Oxford & IBH Co., Delhi.
3. Jain & Jai Krishna, Plain & Reinforced Concrete, Vol-II, Nem Chand & Co., Roorkee.
4. IS 1343-1980 code of Practice for Prestressed Concrete, Bureau of standards, New Delhi.

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-515	High Rise Buildings	3-1-0	4	60	40	100	3 hours

1. **Principles of Planning of Tall Buildings:** Technological Planning, Mechanical systems, Fire rating, local considerations, Structures elements, Types of structural systems for tall buildings, Shear Walls and their arrangement.
2. **Loads on Tall Buildings:** Gravity loads, Live loads, Wind loads and seismic loading, Code Provisions, Discussion of relevant codes of practices and loading standards.
3. **Analysis of Tall Buildings (With and Without Shear Walls):** Approximate analysis for gravity loads, Lateral loads, Analysis of tube-in-tube constructional and 3-Dimensional analysis of shear core buildings, Stability, Stiffness and fatigue, Factor of safety and load factor.
4. **Design of Tall Buildings:** Procedures of elastic design, Ultimate strength design and Limit state design of super structures including structural connections, soil structure interaction.

Books recommended:

1. Structural Analysis and design of Tall Buildings by Tara Nath Bungale
2. Advances in tall buildings by Beedle L.S.
3. Analysis of Shear walled buildings
4. Design of multistory reinforced concrete buildings for earthquake motion by J.A. Blume, N.M. Newmark.

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-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. Neville
2. Concrete Technology-M.L. Gambhir.

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-514	Stability Theory in Structural Engineering	3-1-0	4	60	40	100	3 hours

**1. Plane Stress & Plane strain:** Plane stress, plane strain, stress and strain at a point. Differential equations of equilibrium, constitutive relations: anisotropic materials, yield criterion, flow rule, boundary conditions, compatibility equation, stress function.

**2. Two-Dimensional problems in rectangular coordinates:** Solutions by polynomials, Saint-Venant's Principle, determination of displacements, bending of beams, solution of two dimensional problem in Fourier series.

**3. Two-Dimensional problems in polar coordinates:** general equations in polar coordinates, pure bending of curved bars, displacements for symmetrical stress distributions, bending of curved bar, distribution in plates with circular holes, stress in a circular disc, general solution.

**4. Analysis of stress & strains in three Dimensions:** Principal stress and strain, shearing stresses and strains, elementary equations, compatibility conditions, problems of elasticity involving pure bending of prismatic bars.

**5. Buckling of columns:** Analysis of columns with various end conditions by differential equations, initially curved members, eccentrically loaded column, secant formulae, p-delta effect, energy methods applied to buckling, stability of columns, beam columns, tie rods with lateral bending.

**6. Torsion of Prismatic Bars:** Torsion of prismatic bars, membrane analogy, torsion of a bar of narrow rectangular cross section, torsion of rectangular bars, solution of torsional problems, torsion of rolled sections, torsion of hollow shaft and thin tubes, torsional buckling, torsional-flexural buckling.

**7. Buckling of frames:** Triangular frames, rigid jointed frames-Analysis of beams columns, method of moment equations, geometrical approach, Multistoreyed-multibay frames.

Books recommended:

1. Timoshenko, S.P., "Theory of Elasticity"
2. Timoshenko, S.P., "Theory of Elastic Stability"
3. Lyenger N.G.R.; "Structural Stability of Columns & Plates"



Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-516	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, Guniting 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.

Books recommended:

1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, (1991).
2. R.T. Allen and S.C. Edwards, Repair of Concrete structures, Blakie and Sons, UK, (1987)
3. M. S. Shetty, Concrete Technology – Theory and Practice, S. Chand and Company, New Delhi, (1992).
4. Santhakumar, A.R., Training Course notes on Damage Assessment and repairs in Low Cost Housing, "RHDC – NBO" Anna University, July (1992).
5. Raikar, R., Learning from failures – Deficiencies in Design, Construction and Service – R & D centre (SDCPL), Raikar Bhavan, Bombay, (1987).
6. N. Palaniappan, Estate Management, Anna Institute of Management, Chennai, (1992).
7. Lakshmipathy, M. et al. Lecture notes of Workshop on Repairs and Rehabilitation of Structures, 29 -30th October 1999, (1999).

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-611	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 coefficient, 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:**

3. Building Repair and Maintenance Management by P. S. Gahlot
4. Maintenance of Buildings by A C Panchdhari.

Subject Code	Subject Name	L-T-P	Cr	Theory	Sessional	Total	Duration
CES-613	Advanced Numerical Analysis	3-1-0	4	60	40	100	3 hours

1. Introduction of Programming Language 'C'.
2. Error analysis, significant digits, inherent errors, numerical errors, absolute and relative error, error propagation, conditioning & stability.
3. Solution of linear simultaneous equation, direct and iterative algorithms based on Gauss elimination, Gauss Jordan method, Gauss Seidel method.
4. Numerical solution to non-linear system of equations, bisection method, false position method, Newton-Raphson method, Secant method, fixed point method.
5. Interpolation formulae, Polynomial forms, linear interpolation, Lagrange interpolation polynomial, Newton interpolation polynomial, forward and backward differences.
6. Numerical differentiation by forward difference quotient. Central difference quotient, Richardson extrapolation and numerical integration by Trapezoidal rule, Simpson's 1/3 rule, Romberg integration, Gaussian integration.
7. Numerical solution of ordinary differential equation by Taylor series method, Euler's method, Runge-kutta method, Picard's method, Heun's method, Polygon method.

Books recommended:

1. Terrence J.Akai, 'Numerical Methods', John Wiley & sons Inc,Singapore,1994.
2. S.S Shastry, 'Introductory Method of Numerical Analysis', PHI Pvt. Ltd.,1997.
3. H.C Saxena, 'Finite Differences and Numerical', S.Chand & CO.Delhi,2001.
4. Baron M.L & Salvadori M.G., 'Numerical Methods in Engineering', PHI Pvt. Ltd.,1963.
5. Curtis F.Gerald & Patricks.O.Wheately, 'Applied Numerical Analysis', 5<sup>th</sup> Ed.,Addison Wesley,1994.
6. Balagurusamy E., 'Numerical Methods', TMH Pub.CO.Ltd.,2001.