M. Tech. in Civil Engineering
(Structural Engineering)

PROPOSED CURRICULUM AND SYLLABUS
(2022 -2023)

Haldia Institute of Technology
Jnanam Vijnanam Sahtan

Dr. D. Adak
Birendra Mondal
Saiakat Shaw

Head
Civil Engineering Department
Haldia Institute of Technology

Department of Civil Engineering
Haldia Institute of Technology
Haldia, Purba Medinipur –721657, India

Sathyabrata Patro (Satra)
8/212

Saiakat Patra (9)
# M. Tech. in Civil Engineering (Structural Engineering)

## CURRICULUM

### SEMESTER I

<table>
<thead>
<tr>
<th>Code</th>
<th>Course of Study</th>
<th>L</th>
<th>T</th>
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<tbody>
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Total - 18 hours (L)+6 hours (P) = 24, Credit = 22, Marks = 800

### SEMESTER II

<table>
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Total - 18(L)+6 (P) = 24hours, Credit = 22, Marks = 800

### SEMESTER III

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Total - 0(L)+24 (P) = 24hours, Credit = 12

* Marks - Thesis will be submitted at the end of Semester IV

### SEMESTER IV

<table>
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Total - 0(L)+24 (P) = 24hours, Credit = 12, *Marks - 400

* Thesis is to be submitted at the end of Semester IV followed by presentation and Viva-voce examination. Thesis – 300 marks, Presentation & Viva-voce = 100 marks

*Total credit for M.Tech course =22+22+12+12 = 68
*Total marks for M.Tech course = 800+800+400 = 2000
## ELECTIVES I

<table>
<thead>
<tr>
<th>Code</th>
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## ELECTIVES III

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## ELECTIVES IV

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</tbody>
</table>
SYLLABUS

SEMESTER - I

MCE/MA/L/101 - Applied Mathematics – 3-0-0 – 100 marks


References

5. Jeffrey R. Chasnov, Matrix Algebra for Engineers Lecture Notes

MCE/CE/L/102 - Theory of Elasticity and Plasticity – 3-0-0 – 100 marks

Two and Three dimensional stress tensors, equations of equilibrium and compatibility in Cartesian and Polar form , plane stress and plane strain problems, stress functions, constitutive relationship. Equations in Cartesian and Polar coordinates systems, bending of beams using Airy’s stress function and analysis of plates, torsion of shafts, Introduction to bifurcation of equilibrium, beam column, plates under axial compression, Stress concentration near holes and at re-entrant corners.
Plasticity – Introduction - Reasons of plasticity - slip lines - Plastic stress-strain relations - Flow rules (associated and non-associated) - Different hardening rules - Yield criteria - Graphical representation of yield criteria,

4. Srinath I S - Advanced mechanics of solids
MCE/CE/L/ 103 - Advanced Structural Analysis – 3-0-0 – 100 marks


References:
1. Matrix Analysis of Frames structures by William Weaver J.R and James M. Gere, CBS publications.
3. Basic Structural Analysis by C.S. Reddy, Tata Mc-Graw hill
4. Matrix Structural Analysis by Madhu B. Kanchi, John Willey publishers
6. Matrix Methods of Structural Analysis by J.L. Meek, Mc-Graw hill

MCE/CE/L/104 - Structural Dynamics – 3-0-0 – 100 marks


References
5. A Papoulis, 1993, Probability, random variables and stochastic processes, McGraw-Hill,
7. Jai Krishna, A. R. Chandrashekhar and Brijesh Chandra, Elements of Earthquake Engineering, South Asian Publishers
8. D. J. Dowrick, Earthquake Resistant Design, John Wiley & Sons

MCE/CE/L/105 - Elective I – 3-0-0 – 100 marks (Choose any one)

MCE/CE/L/105A - Advanced Foundation Engineering – 3-0-0 – 100 marks


References

MCE/CE/L/105B - Construction Technique, Safety and Management – 3-0-0 – 100 marks


Construction Safety :- Causes of Accidents on various sites, safety measures and safety policies, determination of safety parameters, personal protective equipment. Workmen Compensation Act, Hazard Identifications and Control Techniques

Construction Management- project life cycle, planning for achieving time, cost, quality, project feasibility reports - Enterprise Resource Planning (ERP), Work break down structure, activity cost and time estimation. LOB technique, Mass haul diagrams. Precedence Network Analysis, Techniques and software, Project Controlling: Monitoring and Control, Arbitration

References:
2. Joy P.K., Total Project Management –The Indian context, Macmillan India Ltd, New Delhi, 1992
6. Construction Management And Equipment by Saurabh K. Soni, S.K. Kataria & Sons
7. Construction Techniques Equipments by Dr. S. Seetharaman
10. Occupational Health And Safety of Construction Workers by Pratibha Joshi
12. Construction Project management, Theory & Practice by Kumar Neeraj Jha

MCE/CE/L/105C - Fluid-Structure Interaction Analysis– 3-0-0 – 100 marks

Circulation and vortices; rotational flow; velocity potential and stream function; vortex flow-free and forced vortex. Equations of motion- Euler’s equation, Bernoulli’s equation; Energy equation; Momentum equation; Dimensionless numbers :- Reynolds number, Froude number, Euler number, Mach number, Weber number etc. Navier-Stokes equation of motion; Potential flow; Boundary layer flow; boundary layer thickness; Prandtl’s Boundary layer equation; separation of boundary layer; laminar flow; Stokes Law; turbulent flow; Flow around immersed bodies - Fluid dynamic drag and lift; total drag, Circulation, Lift and Magnus effect. Introduction to Computational Fluid Dynamics (CFD analysis). Wind effect on Structures. Concept of wave, Linear and non-linear wave theories, fluid - structure interaction problems, Analysis of fixed and floating type structures.

References
2. R. K. Bansal - A Textbook of Fluid Mechanics - Publisher, Firewall Media, 2005
5. Harald E, Krogst R, Ogsta D and Oivind A. Aarnstsen - Regular waves - Norwegian University of Science and Technology, Trondheim, Norway

MCE/CE/L/105 - Elective II– 3-0-0 – 100 marks (Choose any one)

MCE/CE/L/106A - Bridge Engineering– 3-0-0 – 100 marks


Reference

MCE/CE/L/106B - Seismic Design of Structures – 3-0-0 – 100 marks

Engineering Seismology: rebound theory, plate tectonics, seismic waves, earthquake size and various scales, local site effects, Indian seismicity, seismic zones of India, theory of vibration etc. Liquefaction & liquefaction potential of soil. Seismic design concepts: Earthquake load on simple buildings, load path, floor and roof diaphragms, seismic resistant building architecture, plan configuration, vertical configuration, pounding effects – mass and stiffness irregularities, torsion in structural system etc., Ductility.

Provision of IS codes (IS1893, IS 13920 and IS4326) – Building systems: Frames, Shear wall, braced frames, Moment Resisting Frames (MRF), Infill walls, Non-structural elements. Calculation of earthquake load on building systems. Design and detailing of frames, shear wall etc. Base isolation, Adoptive systems etc.

References
1. Pankaj Agarwal and Manish ShriKhande, Earthquake Resistant Design of Structures, Prentice- Hall of India, 2007, New Delhi
3. Robert Park and Thomas Pauly – Reinforced Concrete Structure – Wiley Publisher

MCE/CE/L/106C -Design of Steel and Composite Structures– 3-0-0 – 100 marks

Design of members subjected to lateral loads and axial loads - Principles of analysis and design of Industrial buildings - Gantry girders and columns, Analysis and design of steel towers, Analysis and Design of Self supporting and Guyed steel Chimney, Design of framed beam connections, Cold formed Steel Sections, Thin walled structures
Introduction to composite design – shear connectors, types of shear connectors, partial and full shear connections. Design of Encased and Infill columns.

References
3. N. Subramanian, Design of steel structures, Oxford University Press
7. C.W. Dunham, Planning of Industrial Structures, John Wiley and Sons 7
10. IS: 800 – 2015

MCE/CE/S/101 - Structural Engineering Laboratory – 0-0-3 – 100 marks
Casting and Testing of R.C beams, Properties of Concrete ingredients – Concrete mix design – Ordinary/ High Performance Concrete, Non-destructive Tests

MCE/CE/S/102 – Seminar -0-0-3 – 100 marks
Each student will submit a report on the assigned topic under the supervision of a faculty member at the end of 1st semester. The evaluation of the report will be followed by a viva-voce in front of faculty members and other post-graduate/ research students. Marks will be given by supervisor (70 marks) and other faculty members (30 marks).
SEMESTER - II

MCE/CE/L/201 - Advanced Structural Design – 3-0-0 – 100 marks

Analysis, design and detailing of RC Flat slab, Grid slab, Silo and Bunker, Analysis, design and detailing of RC Water Towers considering wind and seismic forces, Analysis, design and detailing of RC Chimney, considering wind and seismic forces including temperature effect.

References
1. Punnia B.C., Design of Reinforced Concrete Structures
2. Krishnaraju, Advanced Reinforced Concrete Design – CBS publisher
3. Robert Park and Thomas Pauly – Reinforced Concrete Structure – Wiley Publisher
4. Bhavikathi S. S., Advanced RCC Design – New Age International Publisher
5. Varghese P.C. – Design of Reinforced Concrete Shells and Folded plates - Prentice Hall

MCE/CE/L/202 - Finite Element Analysis – 3-0-0 – 100 marks


References
5. Klaus-Jürgen Bathe - Finite element procedures
MCE/CE/L/203 - Theory of Plates and Shells – 3-0-0 – 100 marks

Simple bending of Plates-Assumptions in thin and thick plate theory-Different relationships- Different Boundary Conditions for plates- Plates subjected to lateral loads – Navier’s method for simply supported plates – Levy’s method- problems with different types of loading. Circular plates subjected to Axi-symmetrical loads—concentrated load, uniformly distributed load and varying load – Annular circular plate with end moments.

Rayleigh-Ritz method – Application to different problems – Finite difference method – Bending of anisotropic plates with emphasis on orthotropic plates – Material Orthotropy – Structural Orthotropy - Plates on elastic foundation. Shells- Classification of shells - Membrane and bending theory for singly curved and doubly curved shells - Various approximations - Analysis of folded plates

References

5. J. Ramachandran ,Thin Shells- Theory and Problems ,Orient Blackswan

MCE/CE/L/204 - Advanced Concrete Technology – 3-0-0 – 100 marks


References

3. A.R. Santhakumar ,Concrete Technology” Oxford University Press,2006
7. M.S. Shetty „Concrete Technology“ S.Chand & company Ltd., New Delhi,2000
10. Godbole P.N., Sonparote R.S., Dhote S.U., Matrix method of Structural Analysis, PHI
15. Igor A. Karnovsky, Olga Lebed „Advace Method of Structural Analysis” Springer.

MCE/CE/L/205- Elective III- 3-0-0 – 100 marks ( Choose any one )

MCE/CE/L/205A - Structures in Aggressive Environment- 3-0-0 – 100 marks

Concrete- Environment interaction; Resistance of concrete to acid, sulphate, chloride etc. Fire and influence of temperature; Steel- Environment interaction; Principles of corrosion phenomenon: Thermodynamics and kinetics; emf/galvanic series, Pourbaix diagram, exchange current density, passivity, Evans diagram, flade potential, Different forms of corrosion: atmospheric/uniform, pitting crevice, intergranular, stress corrosion, corrosion fatigue, dealloying, high temperature oxidation-origin and mechanism with specific examples, Corrosion testing and monitoring: Non-Electrochemical and Electrochemical methods: weight loss method, Tafel Linear polarization and Impedance techniques, Lab, semi plant & field tests, susceptibility test. Corrosion prevention: coatings, inhibitors, cathodic, anodic protection, specific applications, economics of corrosion control, Corrosion & its control in industries: Corrosion and its control in different engineering materials: concrete structures, ceramics, composites and polymers.

References
4. Zongjin Li - Advanced Concrete Technology, John Wiley & Sons
5. V.S Ramachandran , Concrete Admixtures Handbook – Properties, Science & Technology
7. M. Richardson – Fundamentals of Durable Reinforced Concrete-Taylor & Francis publisher

MCE/CE/L/205B - Design of Tall Structures– 3-0-0 – 100 marks

Design philosophy: Architectural planning and Structural design of tall structures: Dead load, Live load, Earthquake load on structures, Wind load on structures, Temperature effect etc. Dynamic analysis, Ductility and ductile frames, P-Δ analysis, Design of building frames, Frame-shear wall interaction, Tall Chimney, Water Towers, Foundation of Tall structures.

References
3. Taranath B.S – Tall building – CRC press
4. Rolf Kalzenbach Stiffen Leppla and Deepankar Choudhury - Foundation systems for
5. Poulos Harry G - Tall building Foundation design - CRC Press

MCE/CE/L/205C - Ground Improvement Techniques – 3-0-0 – 100 marks

Principles of ground improvement; Mechanical densification; Drop hammer and compaction pile; Compaction of cohesive soils, pre-loading and vertical drains, stone columns and granular piles; Admixture stabilization; Grouting; Geotextile application. Introduction to Bacterial remediation.

Reference
2. Jie Han, Principles and Practice of Ground Improvement Paperback – 2018
3. Purushothama Raj - Ground Improvement Techniques
6. Maity Joyanta and Chattopadhyay Bikash Chandra – Ground Improvement Techniques

MCE/CE/L/206 - Elective IV – 3-0-0 – 100 marks (Choose any one)

MCE/CE/L/206C - Prestressed and Prefabricated Structures – 3-0-0 – 100 marks


References
3. Arthur H Nilson - Design of Prestressed Concrete – Wiley Publisher
4. IS 1343
5. Krishnaraju - Prestressed Concrete

MCE/CE/L/206C - Repair & Retrofitting of Structures – 3-0-0 – 100 marks

Appraisal of damage and deterioration of structures by non-destructive and other techniques; Cause of deterioration; Environmental, earthquake effects etc. Repair and strengthening of superstructure – structural components, load bearing wall, panel walls; Strengthening of foundation; Grouting; Grout material, Guniting, Shotcreting, under pinning etc. Repair of structures - Building, Bridge, Towers etc., Monuments and Historical structures. Prevention of water leakage in structures; Underwater repair; Durability of repairing material; Case histories.

References
1. Raikar, R.N., Learning from failures – Deficiencies in Design, Construction and
MCE/CE/L/206C - Soil-Structure Interaction Analysis – 3-0-0 – 100 marks


References

MCE/CE/S/201 - Computer Aided Analysis & Design Laboratory – 0-0-3 - 100marks

Computer aided structural analysis & design, using different packages.
Computer aided drafting: - Preparation of plan, elevation and section drawings of simple structure – Introduction to 3D - DBMS concepts - Civil Eng. Databases – Data entry & reports. Spreadsheet concepts – Worksheet calculations in Civil Engineering

References
3. Richard L. Burden - Numerical Analysis

MCE/CE/S/202 – Term paper leading to Thesis – 0-0-3 - 100marks

Each student will submit a report on the assigned research problem under the supervision of a faculty member at the end of 2\textsuperscript{nd} semester. The evaluation of the report will be followed by a viva-voce in front of faculty members and other post-graduate/ research students. Marks will be given by Supervisor (70 marks) and other faculty members (30 marks).

Thesis – 3\textsuperscript{rd} & 4\textsuperscript{th} semester – 0-0-24 – 400 marks

Each student will devote full time in the 3\textsuperscript{rd} & 4\textsuperscript{th} semester on an assigned research problem under the supervision of a faculty member. He/She will submit & present the thesis at the end of the 4\textsuperscript{th} semester.
of the 4th semester which will be evaluated by a board of examiners consisting of the Supervisor and External examiner. The evaluation of the thesis will be followed by a viva-voce in front of faculty members and other post-graduate/ research students. Marks will be given by Supervisor and External examiner.