M. Tech. in Civil Engineering
(Structural Engineering)

PROPOSED CURRICULUM AND SYLLABUS
(2022 -2023)

8/7/22
(SASANK SEKHAR HOTA)

Ajit Kumar Panja
(Panja)

Abhishek Naskar
Anbaskar

Yellanki Deepti
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Bijoli Mondal
(Bijoli Mondal)

Debanjan Das
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HALDIA INSTITUTE OF TECHNOLOGY
JNANAM VIJNANAM SAHITAM

Dr D. Adak
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SAIKAT PANJA (SP).

M. Tech. in Civil Engineering (Structural Engineering)

CURRICULUM

SEMESTER I

Code	Course of Study	L	T	P	C	Marks
MCE/MA/L/101	Applied Mathematics	3	0	0	3	100
MCE/CE/L/102	Theory of Elasticity and Plasticity	3	0	0	3	100
MCE/ CE/L/103	Advanced Structural Analysis	3	0	0	3	100
MCE/ CE/L/104	Structural Dynamics	3	0	0	3	100
MCE/ CE/L/105	Elective – I	3	0	0	3	100
MCE/ CE/L/106	Elective – II	3	0	0	3	100
MCE/ CE/S/101	Structural Engineering Laboratory	0	0	3	2	100
MCE/ CE/S/101	Seminar	0	0	3	2	100
		18	**0**	**6**	**22**	800

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

SEMESTER II

Code	Course of Study	L	T	P	C	Marks
MCE/ CE/L/201	Advanced Structural Design	3	0	0	3	100
MCE CE//L/202	Finite Element Analysis	3	0	0	3	100
MCE/ CE/L/203	Theory of Plates and Shells	3	0	0	3	100
MCE/ CE/L/204	Advanced Concrete Technology	3	0	0	3	100
MCE/ CE/L/205	Elective – III	3	0	0	3	100
MCE/ CE/L/206	Elective – IV	3	0	0	3	100
MCE/ CE/S/201	Computer Aided Analysis & Design Laboratory	0	0	3	2	100
MCE/ CE/S/202	Term Paper Leading to Thesis	0	0	3	2	100
		18	**0**	**6**	**22**	**800**

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

SEMESTER III

Code	Course of Study	L	T	P	C	Marks
T/MCE/301	**Thesis**	**0**	**0**	**24**	**12**	*-

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

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

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SEMESTER IV

Code	Course of Study	L	T	P	C	
T/MCE/301	**Thesis**	**0**	**0**	**24**	**12**	***400**

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

Code	Course of Study	L	T	P	C
MCE/L/105A	Advanced Foundation Engineering	3	0	0	3
MCE/L/105B	Construction Technique, Safety and Management	3	0	0	3
MCE/L/105C	Fluid-Structure Interaction Analysis	3	0	0	3

ELECTIVES II

Code	Course of Study	L	T	P	C
MCE/L/106A	Bridge Engineering	3	0	0	3
MCE/L/106B	Seismic Design of Structures	3	0	0	3
MCE/L/106C	Design of Steel and Composite Structures	3	0	0	3

ELECTIVES III

Code	Course of Study	L	T	P	C
MCE/L/205A	Structures in Aggressive Environment	3	0	0	3
MCE/L/205B	Design of Tall Structures	3	0	0	3
MCE/L/205C	Ground Improvement Techniques	3	0	0	3

ELECTIVES IV

Code	Course of Study	L	T	P	C
MCE/L/206A	Prestressed and Prefabricated Structures	3	0	0	3
MCE/L/206B	Repair & Retrofitting of Structures	3	0	0	3
MCE/L/206C	Soil-Structure Interaction Analysis	3	0	0	3

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SYLLABUS

SEMESTER - I

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

Vector and Tensor : Co-ordinate transformation, Matrix algebra – Inversion of high order matrices – Gauss elimination , Gauss – Jordon, Band approximation approaches etc. Solution of matrix polynomials, Solution of Eigen values and Eigen vectors of matrix - Quadratic form - Hermition form - Canonical form. Numerical integration – Gauss – Quadrature approach, Fourier, Bessel and Legendre series and functions , Partial differential equations , Two dimensional Laplace transform etc. Probability and Statistics: Definition and postulates of probability, Field of probability, Mutually exclusive events, Baye's Theorem, Independence, Bernoulli trial, Discrete Distributions, Continuous distributions, Probable errors, Linear regression, Introduction to non-linear regression, Correlation, Analysis of variance. Probability density function of random variables, Joint Probability in two dimension.

References

1. Grewal B.S, Higher Engineering Mathematics, Khanna publishers, 1997.
2. Venkataraman, M.K., Higher Mathematics for Engineers, National Publishing Co., 1986.
3. Erwin Kreyszig & Herbert Kreyszig & Edward J. Norminton , Advanced engineering mathematics – 2011
4. Gregory Hartman, Fundamentals of Matrix Algebra Publisher: APEX Calculus, 2011, Virginia Military Institute
5. Jeffrey R. Chasnov, Matrix Algebra for Engineers Lecture Notes

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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,

1. Timoshenko and Goodier, Theory of Elasticity, McGraw-Hill, 2006.
2. Wang, Applied Elasticity, Dover Publications Inc. Newyork. 1985.
3. W.F. Chen and D.J. Pan., Plasticity for Structural Engineers, Springler Verlag 1998.
4. Srinath I S - Advanced mechanics of solids

MCE/CE/L/ 103 -Advanced Sructural Analysis– 3-0-0 – 100 marks

Introduction to matrix methods of analysis – static indeterminacy and kinematic indeterminacy – degree of freedom – coordinate system – structure idealization stiffness and flexibility matrices – Analysis of plane truss – continuous beam – plane frame and grids by flexibility methods. Analysis of plane truss – continuous beam – plane frame and grids by stiffness methods. suitability element stiffness equations – elements flexibility equations – mixed force – displacement equations – for truss element, beam element etc.. Transformation of coordinates – element stiffness matrix – and load vector – local and global coordinates. Assembly of stiffness matrix from element stiffness matrix – direct stiffness method – general procedure – band matrix – semi bandwidth – computer algorithm for assembly by direct stiffness matrix method. Introduction to Hybrid techniques

References:

1.Matrix Analysis of Frames structures by William Weaver J.R and James M. Gere, CBS publications.
2.Advanced Structural Analysis by Ashok. K. Jain, Nem Chand Brothers.
3.Basic Structural Analysis by C.S. Reddy, Tata Mc-Graw hill
4.Matrix Structural Analysis by Madhu B. Kanchi, John Willey publishers
5.Indeterminate Structural Analysis by K.U. Muthuet al., I.K. International Publishing House Pvt. Ltd.
6.Matrix Methods of Structural Analysis by J.L. Meek, Mc-Graw hill
7.Moshe, F., Rubenstein, Matrix Computer Analysis of Structures, Prentice Hall, New York, 1966.
8.Kanchi, Matrix Structural Analysis, Wiley Eastern Ltd., Newdelhi 1981.
9.Rajasekaran S, Computational Structural Mechanics, Prentice Hall of India. New Delhi, 2001.

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

Introduction to Dynamic analysis - Elements of vibratory systems and simple Harmonic Motion- Mathematical models of SDOF systems - Evaluation of damping effects.Duhamel's integral – Numerical methods , Deterministic analysis of SDOF systems under Earthquake/blasting etc. .Solution of the Eigen value problem including iterative methods. Mathematical models of MDOF systems , Dynamic analysis of Multi-storied frames , Mode superposition, Vibration of continuous elastic media – Beam, Plates etc. Dynamic analysis using codes/guidelines/ methods, Introduction to Random vibration – Stochastic analysis

References

1. Mario Paz, and William Leigh, Structural Dynamics, CBS, Publishers, 1987.
2. Roy R Craig, Jr., Structural Dynamics, John Wiley & Sons, 1981.
3. A.K. Chpora "Dynamics of Structures Theory and Application to Earthquake Engineering" Pcarson Education, 2001.
4. N C Nigam, 1983, Introduction to random vibrations, MIT Press, Boston.
5. A Papoulis, 1993, Probability, random variables and stochastic processes, McGraw-Hill,
6. R E Melchers, 1999, Structural reliability analysis and prediction, John Wiley, Chichester.

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7. .Jai Krishna, A. R. Chandrashekhar and Brijesh Chandra, Elements of Eathquake Engineering , South Asian Publishers
8. D. J. Dowrick, Earthquake Resistant Design, John Willey & Sons
9. Dynamics of structures, W. Clough and Joseph Penzien, McGraw-Hill, New York

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

Bearing Capacity of flat and Sloped surface, Settlement Analysis of Foundations in Sand and Clay, Settlement of Piles; Vertical and Lateral resistance of single piles. Negative skin friction of piles; Uplift capacity of piles and anchors; Stability of slopes; Foundations on expansive soils; Well foundations; Machine foundations. Introduction to Soil dynamics. : liquefaction & liquefaction potential.

References

1. J.E. Bowles, "Foundation Analysis and Design", McGraw Hill, 1996.
2. M.J. Tomlinson, "Foundation Design and Construction", Addison Wesley, 2001.
3. M.J. Tomlinson, "Pile Design and Construction Practice", E & FN Spon, 1987.
4. Braja M. Das., "Principles of Foundation Engineering", Thomson Asia Pte , 1987, London Ltd., Singapore, 2005, A viewpoint publication.
5. P.C. Varghese, "Foundation Engineering", Prentice-Hall of India, New Delhi, 2005.

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

Construction Techniques :- Slip form construction , High rise building construction , Bridge construction, Tunnel construction etc. use of Heavy equipments for construction :-Excavators, bulldozers, loaders, cranes, and dump trucks , Boom Lift. Forklift. Single Man Lift. Telehandler, Wheel Tractor-Scraper. Skid Steer Loader. Backhoe Loader ,Excavator , Asphalt Paver, Motor Grader, Compactor ,Cold Planer , Drum Roller etc.

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:

1.Chitkara.K.K, Construction Project Management: planning, Scheduling and control, Tata McGraw Hill Publishing Company, New Delhi, 1998.
2.Joy.P.K, Total Project Management –The Indian context, Macmillan India Ltd, New Delhi,1992
3.Vohra.N.D., Quantitative Techniques in Management, Tata Mcgraw Hill Publishing Company, New Delhi, 1998.
4.Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997.
5.Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001
7.Construction Management And Equipment by Saurabh K. Soni, S.K. Kataria & Sons
8. Construction Techniques Equipments by Dr.S. Seetharaman

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9. Construction Safety by R.K. Mishra
10. Occupational Health And Safety of Construction Workers by Pratibha Joshi
11. Project Management in Construction, 6th Edition by Anthony Walker
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

1.S K Som , Gautam Biswas , S Chakraborty - Introduction to Fluid Mechanics and Fluid Machines Paperback – 2017 - McGraw-Hill
2. R. K. Bansal - A Textbook of Fluid Mechanics - Publisher, Firewall Media, 2005
3. Bruce R. Munson, Alric P. Rothmayer -Fundamentals of Fluid Mechanics - Wiley publisher -2017
4. Yunus A. Çengel John M. Cimbala - Fluid Mechanics Fundamentals and Applicatins
5. Harald E, Krogst R, Ogsta D and Øivind A. Arntsen - Regular waves Norwagian University of Science and Technology, Trondheim, Norway
6. J.C Upadhyaya – Mechanics and Wave motion - 2019
7. Richard Manasseh - Fluid Waves – CRC press - 2021
8. Kristian B Dysthe -Lecture notes on linear wave theory. - 2004. Department of Mathematics University of Bergen Norway June 2, 2004

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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

Components of Bridges, Classification. Investigation for Bridges:- Selection of Bridge site – Economical span – Location of piers and abutments – Subsoil exploration – Scour depth – Traffic projection – Choice of bridge type. Specification of road bridges:- width of carriageway , loads to be considered , dead load , IRC load specification: live load, Impact effect. General design considerations — Slab Bridge , Design of T-beam bridge , Arch Bridge , Box girder bridge etc. Evaluation of sub structures:- Pier and abutments caps – Design of pier – Abutments – Type of foundations. Importance of Bearings – Bearings for slab bridges – Bearings for girder bridges – Electrometric bearing – Joints – Expansion joints. Construction and Maintenance of bridges. Lessons from bridge failures.

Reference

1. Ponnuswamy, S., Bridge Engineering, Tata McGraw – Hill, New Delhi, 1997.
2. Victor, D. J., Essentials of Bridge Engineering, Oxford and IBH, 1980.
3. N. Rajagopalan, Bridge Superstructure, Narosa Publishing House, New Delhi,2006.
4. Jagadeesh. T. R. and Jayaram. M. A., Design of Bridge Structures,

PrenticeHall of India Pvt. Ltd., 2004.
5. Raina. V. K., Concrete Bridge Practice, Tata McGraw Hill Publishing Company, New Delhi, 1991.

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
2. Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.
3. Robert Park and Thomas Pauly – Reinforced Concrete Structure – Wiley Publisher
4. Somnath Ghosh and Arundeb Gupta – Design of Wind and Earthquake resistant Reinforced Concrete Buildings – CRC press – Taylor & Francis - 2021

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

1. Arya, A.S., Design of Steel Structures, New Chand & Brothers, New Delhi 1982.
2. R.P. Johnson, "Composite Structures of Steel & Concrete", Blackwell Scientific publications, UK, 1994.
3. N. Subramanian, Design of steel structures, Oxford University Press
4. S.K. Duggal, Limit state design of steel structures (2nd edition), McGraw Hill India, New Delhi.
5. M.L. Gambhir, Fundamentals of structural steel design, McGraw Hill India, New Delhi
6. Karuna Moy Ghosh , Analysis and design of steel structures, 2nd ed. Prentice Hall, India
7. C.W. Dunham, Planning of Industrial Structures,John Wiley and Sons7.
8. S. M. A. Kazimi and R. S. Jindal, Design of Steel Structures, Prentice Hall of India Pvt. Ltd
9. M. Edwin, J. Gaylord and J. E. Stallmeyer, Design of Steel Structures, McGraw Hill
10. IS: 800 – 2015

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11. Punmia, Design of Steel Structures" Firewall Media, 1998.
12. S.S. Bhavikatti „Design of Steel Structures" I.K. International Publishing House Pvt. Ltd. , 2012

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).

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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. Punmia 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
6. Somnath Ghosh and Arundeb Gupta – Design of Wind and Earthquake resistant Reinforced Concrete Buildings – CRC press – Taylor & Francis - 2021

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

Strain-displacement relation - linear constitutive relation - special cases- Principle of potential energy , Introduction to finite element approches. Some numerical techniques used in finite element Analysis, Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function- Linear and quadratic elements - Lagrange & Serendipity elements – Strain- displacement matrix - element stiffness matrix and nodal load vector, Two dimensional Isoparametric elements - Four noded quadrilateral elements - triangular elements- Computation of stiffness matrix including numerical integration (Gauss quadrature technique) - Convergence criteria. Assemblage of elements – Direct stiffness method- Special characteristics of stiffness matrix - Boundary condition & reaction - Gauss elimination and LDL^T decomposition- Basic steps in finite element analysis. Plane stress and plane strain analysis: Triangular elements - Rectangular elements, Analysis of framed Structures- 2D truss element - 2D beam element. Analysis of plate bending: - displacement functions - plate bending elements, stiffness matrix etc.. Introduction to Boundary Element technique.

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References

1. Krishnamoorthy, C.S, Finite Element Analysis Theory & Programming, McGraw-Hill, 1995.
2. Desai C.S and Abel, J.F., Introduction to the finite element Method, Affiliated East west Press Pvt. Ltd. NewDelhi 2000.
3. Cook R D, 1995, Finite element modelling for stress analysis, John Wiley
4. Mukhopadhyay M., Matrix, finite element, computer and structural analysis, ANE Books.
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

1. Rudolph Szilard, Theory and Analysis of Plates, Prentice Hall, New Jercy 1986.
2. Stephen .P. Timoshenko & Woinowsky Krieger, Theory of Plates and Shells, Mc Graw Hill, 1984.
3. J.N. Reddy,Theory and Analysis of Elastic Plates and Shells,CRC Press
4. K. Bhaskar, T.K. Varadan, Plates –Theories and Applications,Wiley-Blackwell
5. J. Ramachandran ,Thin Shells- Theory and Problems ,Orient Blackswan
6. Chandrasekhara K, 2000, Theory of plates, Universities Press

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

Mixing, transportation, placing and compaction of concrete; Effect of Chemical and Mineral admixtures on fresh and hardened concrete; Durability of concrete; Rheological behaviour of fresh Concrete. Micro-Structural properties of concrete. Properties and mix proportioning of flyash concrete, silica fume conrete . Properties of fresh and hardened high performance concrete :- Fibre reinforced concrete, Sprayed concrete, Self compacting concrete, Lightweight / Foam concrete; Ultra high strength concrete; Ready mix concrete, Roller compacted concrete, Pumped concrete etc. . Geopolymer concrete, Blended Alkali Activated Concrete. Long term behavior of concrete. Concrete under elevated temperature and fire.

References

1. Krishnaraju, N., Advanced Concrete Technology, CBS Publishers, 1985.
2. Nevile, A.M., Concrete Technology, Prentice Hall, Newyork, 1985.
3. A.R. Santhakumar, :Concrete Technology" Oxford University Press, 2006
4. K. Mehta „Concrete, Structures, Properties and Materials" Prentices-Hall, Inc., New Jersey, USA.
5. M.L. Gambhir „Concrete Technology" Tata McGraw Hill, New Delhi.
6. J.H. Bungey „Testing of Concrete in Structures" Surrey Univ Press, New York.
7. M.S. Shetty „Concrete Technology" S.Chand & company Ltd., New Delhi,2000
10. Ghali A, Neville AM, 2017, Structural Analysis: A Unified Classical and Matrix Approach, 7e, CRC Press
11. Wang C. K., Intermediate Structural analysis, Mc-Graw Hill
12. Godbole P.N., Sonparote R.S., Dhote S.U., Matrix method of Structural Analysis, PHI

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13. Devdas Menon „Advanced Structural Analysis" Narosa, 2009.
14. Jan J. Tuma „Advanced Structural Analysis" McGraw-Hill, New Delhi, 1971.
15. Igor A. Karnovsky, Olga Lebed „ Advace Method of Structural Analysis" Springer.
16. Sidney F. Borg, Joseph J. Gennaro „Advanced Structural Analysis" Van Nostrand, 1959.

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 fatique, dealloying, high temperature oxidation-origin and mechanism with specific examples ,Corrosion testing and monitoring: Non-Elecrochemical 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 contron, Corrosion & its control in industries: Corrosion and its control in different engineering materials: concrete structures, ceramics, composites and polymers.

References

1. Fontana. M.G., Corrosion Engineering, Tata McGraw Hill, 3rd Edition, 2005.
2. Jones.D.A. Principles and Prevention of Corrosion, 2nd Edition, Prentice Hall, 1996.
3. K. Mehta „Concrete, Structures, Properties and Materials" Prentices-Hall, Inc., New Jersey, USA.
4. Zongjin Li - Advanced Concrete Technology, John Wiley & Sons
5. V.S Ramachandran , Concrete Admixtures Handbook – Properties, Science & Technology
6. Mark Alexander, Arnon Bentur and Sidney Mindess - Durability of Concrete – CRC Press
7. M. Richardson – Fundamentals of Durable Reinforced Concrete-Taylor & Francis publisher

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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

1. Bryan Stafford smith and Alex coull, Tall Building Structures – Analysis and Design, John Wiley & sons, 2006.
2. Somnath Ghosh and Arundeb Gupta – Design of Wind and Earthquake resistant Reinforced Concrete Buildings – CRC press – Taylor & Francis – 2021
3. Taranath B.S – Tall building – CRC press
4. Rolf Kalzenbach Stiffen Leppla and Deepankar Choudhury - Foundation systems for

High –Rise Structures – CRC Press
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

1. Bujang B.K. Huat , Arun Prasad, Sina Kazemian, Vivi Anggraini - Ground Improvement Techniques-CRC Press, 2019
2. Jie Han, Principles and Practice of Ground Improvement Paperback – 2018
3. Purushothama Raj - Ground Improvement Techniques
4. Bujang B.K. Huat, Arun Prasad, Sina Kazemian - Ground Improvement Techniques · 2019
5. Patra,N.R. - Ground Improvement Techniques -Vikash Publishing House Pvt Ltd – 2012
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

Principles of prestressing, Materials of prestressing ,Systems of prestressing ,Loss of prestress : Loss analysis , Deflection of Prestressed Concrete members. Pre-tensioned and Post-tensioned beams : Design for flexure, bond and shear - Ultimate flexural and shear strength of prestressed concrete sections , Design of end anchorage zones, Composite beams : Analysis and design. Partial prestressing. Analysis of Continuous beams: Cable layout etc Design of compression and tension members. Circular prestressing

References

1.Lin. T.Y., Burns, N.H., Design of Prestressed Concrete Structures, John Wiley, 1982.
2.RajaGopalan N. Prestressed Concrete, Narosa Publishing House, New Delhi, 2002.
3. Arthur H Nilson - Design of Prestressed Concrete – Wiley Publisher
4. IS 1343
5. Krishnaraju - Prestressed Concrerte

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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

Service – R&D Centre (SDCPL), Raikar Bhavan, 1987.
2. Allen R.T., and Edwards S.C, Repairs of Concrete Structures, Blaike and Sons, U.K.198

MCE/CE/L/ 206C -Soil-Structure Interaction Analysis– 3-0-0 – 100 marks

Introduction to Soil-Foundation Interaction: Subgrade reaction, Time dependent behavior, Foundation behaviour, Interface behaviour, Soil response models, Winkler approach, Elastic continuum, Beam on Elastic Foundation- Infinite and finite beams, Thin and thick plates on elastic soil including numerical approaches. Elastic analysis of pile using p-y curves. Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups piles. Load deflection prediction for laterally loaded piles. Soil - Structure elastic analysis of Isolated and Strip footing, Raft, Raft-Pile etc. An introduction to Soil-Foundation interaction under dynamic loads.

References

1. Selva durai, A. P. S, Elastic Analysis of Soil-Foundation Interaction, Elsevier, 1979.
2. Poulos, H. G., and Davis, E. H., Pile Foundation Analysis and Design, John Wiley, 1980.
3. J.E. Bowles, "Foundation analysis and design", McGraw Hill 1996.

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

Computer aided numerical analysis: Regression & Matrix Inversion. Development of C programs to solve problems using numerical techniques ,Roots of an equation using Newton – Raphson method, Solution of linear simultaneous equations using Gauss elimination, Matrix inversion using GJ method, Linear regression line of given points, Curve fitting using Polynomial Regression, Eigen value extraction power method
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

1. Rajaraman, V., Computer Oriented Numerical Methods, Prentice – Hall of India, 2004.
2. Sastry S.S -Introductory Methods of Numerical Analysis Paperback – 2012- Prentice Hall
3. Richard L. Burden - Numerical Analysis
4. Mahinder Kumar Jain - Numerical Methods: For Scientific And Engineering Computation – 2019- New age International Publisher

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 2nd 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).

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Thesis – 3rd & 4th semester – 0-0-24 – 400 marks

Each student will devote full time in the 3rd & 4th 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 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.

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