

CE/CS/EB/EC/EE/EI/ME/IT/SE 501 ENGINEERING MATHEMATICS IV

MODULE 1

Probability distributions: random variables (discrete & continuous), Probability density, mathematical expectation, mean and variance of a probability distribution, binomial distribution, Poisson approximation to the binomial distribution, uniform distribution, normal distribution.

Curve fitting: method of least squares, correlation and regression, lines of regression.

Module II

Sampling distributions: Population and samples, the sampling distribution of the mean unknown (σ known), the sampling distribution of the mean (σ) the sampling distribution of the variance, point estimation, interval estimation, tests of hypotheses, null hypotheses and significance tests, hypothesis concerning one mean, type I and type II errors, hypotheses concerning two means. The estimation of variances: Hypotheses concerning one variance – Hypotheses concerning two variances.

Module III

Finite difference Operators: ∇ , Δ , E , δ , μ , $x^{(n)}$

Newton's Forward and Backward differences interpolation polynomials, central differences, Stirlings central differences interpolation polynomial. Lagrange interpolation polynomial, divided differences, Newton's divided differences interpolation polynomial.

Numerical differentiation: Trapezoidal and Simpson's rules, compounded rules, errors of interpolation and integration formulae. Gauss quadrature formulae (No derivation for 2 point and 3 point formulae)

Module IV

Numerical solutions of ordinary differential equations: Taylor series method, Euler's method, modified Euler's method, Runge-Kutta formulae 4th order formula,

Numerical solution of boundary value problems: Methods of finite differences, finite difference methods for solving Laplace's equation in a rectangular region, finite differences methods for solving the wave equation and heat equation.

REFERENCES:

1. Numerical Methods: P.Kandaswamy, K.Thilagavathy, K.Gunavathy, S.Chand & Co.
2. Probability, Random Variables and Stochastic Processes A.Papoulis, Mgh Publishers
3. Probability And Statistics For Engineers: Irvin Miller & Freund, Prentice Hall Of India
4. Numerical Methods: S.S.Sastry, Phi Publishers

Type of Questions for University Exam.

Q 1. Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

CE 502A/B Analysis of Structures I

Module I

Deflection of statically determinate trusses: methods of joints and sections – methods for determination of deflection of truss joints – the unit-load method – the angle weights method – joint displacement equation method – graphical method: Willot-Mohr diagram

Analysis of statically indeterminate trusses: degree of indeterminacy – force method using reactions as redundant – force method using reactions as redundant – force method using axial forces in members as redundant – force method using both reactions and axial forces in members as redundant – induced reactions on statically indeterminate trusses due to yielding of support

Module II

Statically indeterminate beams and frames: strain energy in tension, torsion and bending – theorem of least work – the reciprocal theorem – induced reactions due to yielding of supports

Three moment equation: derivation of three moment equation – application of three moment equation to analysis of continuous beams subjected to applied loads – analysis of continuous beams subjected to uneven support settlement

Module III

Slope deflection method: derivation of the slope-deflection equation: without rotation of member axis – analysis of statically indeterminate beams subjected to applied loads – derivation of the slope-deflection equation: with rotation of member axis – analysis of statically indeterminate beams subjected to uneven support settlement – analysis of statically indeterminate rigid frames: without unknown joint translation – analysis of statically indeterminate rigid frames: with unknown joint translation – analysis of statically indeterminate rigid frames subjected to support settlement – analysis of gable frames

Module IV

Moment distribution method: stiffness and carry over factors – distribution factors – analysis of statically indeterminate beams subjected to applied loads – check on moment distribution – modified stiffness factors at the near end when far end is hinged – analysis of statically indeterminate beams subjected to uneven support settlement – analysis of statically indeterminate rigid frames: without unknown joint translation – analysis of statically indeterminate rigid frames: with unknown joint translation – analysis of statically indeterminate rigid frames subjected to support settlement – analysis of gable frames

Reference

- 1) Khurmi – Theory of Structures – S Chand
- 2) Wang C.K – Intermediate Structural Analysis, McGraw Hill International Edition.
- 3) Timoshenko S.P. & Young D.H – Theory of Structures, McGraw Hill International Edition.

Type of Questions for University Exam.

Q 1. Eight short answer questions of 5 marks with two questions from each of the four modules.

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CE 503A/B Design of Structures I

Module I

Concrete structures: Concrete, reinforced concrete and prestressed concrete – structural forms – loads – serviceability, strength and structural safety – design basis – design codes and specifications **Material properties:** Properties in compression – tensile strength – strength under combined stress – shrinkage and temperature effects – high strength concrete – reinforcing steels for concrete **Design Philosophy.**

Flexural analysis and design of beams: Bending of homogeneous beams – reinforced concrete beam behaviour – design for tension reinforcement in rectangular reinforced concrete beam – design aids – practical considerations to design of beams – rectangular beams with tension and compression reinforcement – design of T-beams

Module II

Shear and diagonal tension in beams: Diagonal tension in homogeneous elastic beams – reinforced concrete beams without shear reinforcement – reinforced concrete beams with shear reinforcement – limit state design of beams – Code provision for shear reinforcement – Beams with varying depth

Analysis and design for torsion: Torsion in plain concrete members – torsion in reinforced concrete members – combined torsion and shear – Limit state design of beams – Code provision for torsion design

Module III

Bond, anchorage and development length: Fundamentals of flexural bond – ultimate bond strength and development length – Code provisions for development of tension reinforcement – anchorage of tension bars by hooks – anchorage requirements for web reinforcement – development of bars in compression – bundled bars – bar cutoff and bend points in beams

Serviceability: Cracking in flexural members – Code provisions for crack control – control of deflection – immediate deflection – deflection due to long term loads – Code provisions for control of deflection – deflection due to shrinkage and temperature changes

Module IV

Edge supported slabs: Types of slabs – design of one-way slabs – temperature and shrinkage reinforcement – behavior of two way edge supported slab – analysis by coefficient method – reinforcement for two way edge supported slab – deflection control - design of stair cases slab – design of continuous slab

Columns: Design of short columns – axial compression – lateral ties and spirals – compression plus bending in rectangular columns – strain compatibility analysis and interaction diagrams – balanced failure – distributed reinforcement – unsymmetrical reinforcement – circular columns – Code provisions for design of short columns – biaxial bending – Design of slender columns – concentrically loaded columns – compression plus bending – Code provisions for design of slender columns.

Reference

- 1) Nilson A.H –Design of Concrete Structures, McGraw Hill Companies Inc.
- 2) Pillai S.U & Menon D – Reinforced Concrete Design, Tata McGraw Hill Publishing Company Limited, New Delhi, India.
- 3) Varghese P.C –Limit State Design of Reinforced Concrete, Prentice Hall of India Pvt Ltd, New Delhi, India.
- 4) Syal and Goel – Reinforced concrete structures – S Chand

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

CE 504A/B Geotechnical Engineering –I

Module I

Nature of soil and functional relationships: Soil types – residual soil and transported soil. Three phase system – void ratio – specific – specific gravity- dry density – porosity-water content-saturate unit weight-submerged unit weight – degree of saturation, Concepts of single grained, honey combed and flocculant structure and their effects on the basic soil properties.

Laboratory and field identification of soils: Determination of water content by oven drying – specific gravity using Pyenometer and specific gravity bottle – grain size analysis by sieve analysis, hydrometer analysis and pipette analysis – Atterberg limit and indices, sensitivity & thixotropy field density by core cutter, sand replacement and wax coating methods. Classification of Soils: Necessity – Principles of classification – I.S. classification – plasticity chart.

Module II

Soil water: Classification- effective stress - total stress - pore pressure - pressure diagrams for different conditions

Permeability: definition - Darcy's law - factors affecting permeability - laboratory determination – permeability of stratified soils

Stress distribution: Boussinesque's and Westergaard's equations for vertical pressure due to point loads and uniformly distributed loads - assumptions and limitations - pressure bulb – Newmarks' charts and their use

Module III

Consolidation: definition - concepts of coefficient of compressibility - coefficient of volume change and compression index - e-log p curves - pre-consolidation pressure - Terzaghi's theory of one dimensional consolidation - determination of coefficient of consolidation - difference between consolidation and compaction

Compaction: definition and objectives of compaction - proctor test and modified proctor test - concept of OMC and maximum dry density - zero air voids line - factors influencing compaction - field compaction methods - Proctor needle for field control

Module IV

Shear Strength: definition - Mohr's strength and stress circles - Mohr's envelope - Mohr-Coulomb strength theory - direct, triaxial and UCC tests - drainage conditions-UU, CU and CD tests - vane shear tests - total and effective stress - strength parameters –

Stability of slopes: slope failure, base failure and toe failure - Swedish circle method - friction circle method - Taylor's stability number - stability charts

Reference

- 1) Gopal Ranjan & Rao A.S.R – Basic and Applied Soil Mechanics, Wiley Eastern Ltd
- 2) Das B.M – Principles of Geotechnical Engineering – Thomas Brooks Cole, Singapore
- 3) Punmia B.C. – Soil Mechanics and Foundations, Saurabh
- 4) Terzaghi K. & Peck R.B. – Soil Mechanics in Engineering Practice, John Wiley
- 5) Venkataramaiah, C- Geotechnical Engineering, New Age International Publishers.

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

CE 505A Transportation Engineering - I

Module I

Classification, Alignment & surveys: Classification of highways – typical cross sectional roads in embankment and in cutting, definition of various cross sectional elements – requirements and factors controlling alignment of roads, Engineering surveys.

Geometrical Design of Highways: Camber – sight distances – Stopping, passing and overtaking Sight distances, Overtaking zone requirements, worked out problems – design of horizontal alignments, design speed – horizontal curves – Super elevation – Super elevation design – radius of horizontal Curve – extra widening of pavement – transition curves and methods of provision of super elevation and design of horizontal alignment – design of vertical alignment – gradient and grade Compensation Vertical curves – summit curves – length of summit curve - valley curves – length of valley curve

Module II

Traffic Engineering: Traffic Characteristics – various traffic studies and their application-traffic regulations and controls – Traffic control Devices – Traffic Signals – classification of signals – carriage way markings – traffic islands – Highway intersections.

Module III

Highway Materials, Testing & Design::Road aggregates – Desirable props & tests – Bituminous materials – Types of bituminous materials used in highway construction – requirements – desirable properties and tests.

Highway construction & Maintenance : Construction of earth roads, Gravel roads WBM roads, Bituminous pavements, Bituminous construction Procedures – Construction of Cement concrete pavements. Joints in Concrete pavements – types and causes of failures in flexible and rigid pavements – Highway drainage. Pavement Design –Basic difference between flexible and rigid pavements – factors to be considered in Design of pavements – Design of flexible pavements by CBR method only.

Module IV

Aircraft characteristics – Regional planning airport site selection – Surveys for site selection Airport obstructions zoning laws-classification of obstructions – Imaginary surfaces. Runway orientation- wind, rose diagram-basic runway length and corrections required- Airport classification – runway configurations. Taxiway Design requirements.

Apron- factors controlling size and number of gate positions –Aircraft parking System – Hangar site location – facilities required in the terminal building-Blast fences-Typical airport layout-airport marking-airport lighting. Air traffic control-Airway aids and landing aids.

Reference

- 1) S.K. Khanna & C.E.G. Justo – Highway Engineering, New Chand & Bros
- 2) L.R. Khadiyali – TrafficEngg. And Transport Planning, Khanna Publishers
- 3) S.K. Khanna, M.G. Arora & S.S. Jain – Airport Planning & Design, New Chand & Bros
- 4) S.C. Rangwala – Airport Engineering, CharoterPublishing House.
- 5) Horenjeef Robert & Francis – Planning & design of airport.

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

CE 505 B TRANSPORTATION ENGINEERING

Module I

Classification of highways – typical cross section of roads in embankment and in cutting, definition of various cross sectional elements – requirements and factors controlling alignment of roads .Camber – sight distanes – Stopping, passing and overtaking Sight distances, Overtaking zone requirements, worked out problems – design of horizontal alignment, design speed – horizontal curves – Super elevation – Super elevation design – radius of horizontal Curve – extra widening of pavement – transition curves and methods of provision of super elevation and design of horizontal alignment – design of vertical alignment – gradient and grade Compensation Vertical curves – summit curves –valley curves (length of summit curve & valley curve only) Road aggregates – Desirable properties and tests Bituminous materials – Types of bituminous materials used in highway construction – requirements – desirable properties and test. Construction of WBM roads, Bituminous roads Cement concrete roads – Joints in Concrete pavements – types and causes of failures in flexible and rigid pavements – Basic difference between flexible and rigid pavements – factors to be considered in design of pavements – design of flexible pavement by CBR method only.

Module II

Aircraft characteristics – airport site selection – Surveys for site selection – Airport obstruction – zoning laws. Runway orientation – Wind rose diagram – basic runway length and corrections required – problems – Runway Configurations – Aircraft parking system – airport marking and lighting.

Module III

Railway Engineering, Permanent way – main requirements – Component parts – rails – functions of rails- requirements of a good rail – weight and length – defects in rails – coning of wheels – creep & wear of rails – Sleeper – its functions and requirements – sleeper density – Ballast – function and requirements Super elevation, negative super elevation in branches – widening of gauge on curves – Principe of track circuiting – control of train movement by Centralized traffic Control systems.Tunnel Engineering
Tunnel alignment – transferring Center grade into tunnel – tunneling through hard and soft rock (only full-face method and Neeble beam Method) – tunnel ventilation and drainage.

Module IV

Harbours Engineering: Classification of harbours – Breakwaters – necessity and functions – different types – Construction of break waters. Dock Engineering: Functions & type of docks – dry docks – floating docks – Dredging – Mechanical and hydraulic dredgers – general study of bucket ladder – Dredger, grab dredger and dipper dredgers.

References:

- 1) S.K. Khanna & C.E.G. Justo : Highway Engineering,New Chand &Bros
- 2) S.K. Khanna, M.G. Arora & S.S. Jain: Airport Planning & Design, New Chand &Bros
- 3) S.C. Rangwala : Airport Engineering,Charoter Publication House
- 4) S.C. Rangwala : Railway Engineering , Charoter Publication House
- 5) Dr. S.D. Bindra : A Course in Docks & Habour Engg,Dhanpatrai& Sons.
- 6) Chandola- A text booki of Transportation Engineering –S Chand

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CE 506A/B Construction Engineering & Management –II

Module I

Construction Equipments : Engineering Fundamentals – Tractors and related equipments – excavating equipments – Bull dozer, power shovel, dragline, Clam shells, scrapers – Hauling and Conveying equipments – Trucks and Wagons - Belt conveyor systems – Cranes.

Module II

Drilling and blasting equipments – Tunneling equipments – equipments for the production of crushed aggregates – Factors affecting selection of equipments.

Managing construction equipments – equipment economics – owning costs – operating costs replacement decision – equipment cost control – plant layout.

Module III

Construction Monitoring: Objects of planning – stages of construction – Construction team – resources of construction industry – objects of management – planning and scheduling – scheduling using bar charts - - limitations of bar chart – Material schedule – labour schedule – equipment schedule – financial schedule – mile stone chart –Gantt Charts

Module IV

CPM and PERT networks – Difference between CPM and PERT – development of a network – representation of various activities and events in a CPM network – Network logic – network calculation – advantages of CPM over bar chart – crashing the programme – crash cost – time cost balancing – progress control – recording progress – methods increasing productivity – PERT network – Selection of network techniques

Reference:

1. Stevens JD – Techniques for construction network scheduling – McGraw Hill Publishing company
2. Arora and bindra – building construction Planning Techniques and methods of construction – Dhanpat rai& Sons
3. Peurifoy,RL, Ledbetter WB & Schexnayder CJ – Construction planning equipment and method – McGraw Hill Publishing company

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules.

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B.

CE 507A Geotechnical Engineering Laboratory

- 1) Determination of Specific gravity, water content and particle size distribution by hydrometer method.
- 2) Determination of field density by core cutter and sand replacement method.
- 3) Determination of Atterberg Limits.
- 4) Compaction tests – I.S. light and heavy compaction.
- 5) California Bearing Ratio Test
- 6) Permeability tests – constant head and variable head methods.
- 7) Consolidation test.
- 8) Shear strength tests – Direct shear, Triaxial, UCC & Vane Shear Test
- 9) Demonstration of field tests like Standard Penetration Test, Dynamic Cone Penetration Test, Static Cone Penetration Test, Electrical Resistivity method, Pressure meter test, Plate load test.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50 % marks separately for the two components to be eligible for a pass in that subject.

CE 507 B Geotechnical Engineering Laboratory

- 1) Determination of Specific gravity, water content and particle size distribution by hydrometer method.
- 2) Determination of field density by core cutter and sand replacement method.
- 3) Determination of Atterberg Limits.
- 4) Permeability tests – constant head and variable head methods.
- 5) Consolidation test & Compaction test –I.S. Light and Heavy compaction
- 6) California Bearing Ratio Test
- 7) Shear strength tests – Direct shear, Triaxial, UCC & Vane Shear Test
- 8) Demonstration of field tests like Standard Penetration Test, Dynamic Cone Penetration Test, Static Cone Penetration Test, Electrical Resistivity method, Pressure meter test, Plate load test.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50 % marks separately for the two components to be eligible for a pass in that subject.

CE 508A Transportation Engineering Laboratory

Test on Road Aggregates

1. Aggregate Crushing Value.
2. Aggregate Impact Value.
3. Aggregate Abrasion Value.

Test on Bitumen

4. Softening point of Bitumen.
5. Ductility test on Bitumen.
6. Specific gravity of Bitumen.
7. Flash and Fire point test.
8. Stripping Value Test.
9. Viscosity using Viscometer.
10. Determination of bitumen content by bitumen extractor.

Test on Bituminous Mixes

11. Marshall Test.
12. Indirect Tensile Test.
13. Creep Test.
14. Resistance to fatigue cracking by repeated load indirect tensile test.
15. Fields Tests.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50 % marks separately for the two components to be eligible for a pass in that subject.

CE 508 B Transportation Engineering Laboratory

Test on Road Aggregates

1. Aggregate Crushing Value.
2. Aggregate Impact Value.
3. Aggregate Abrasion Value.

Test on Bitumen

1. Softening point of Bitumen.
2. Ductility test on Bitumen.
3. Specific gravity of Bitumen.
4. Flash and Fire point test.
- 5 Stripping Value Test.
6. Viscosity using Viscometer.
7. Determination of bitumen content by bitumen extractor.

Test on Bituminous Mixes

1. Marshall Test.
2. Indirect Tensile Test.
3. Creep Test.
4. Resistance to fatigue cracking by repeated load indirect tensile test.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50 % marks separately for the two components to be eligible for a pass in that subject.