ERC901: RESEARCH METHODOLOGY

Module I

Objectives and types of research: Motivation and objectives – Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs Fundamental, Quantitative vs, Qualitative vs, Empirical.

Module II

Research Formulation - Defining and formulating the research problem – Selecting the problem – Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web – Critical literature review – Identifying gap areas from literature review – Development of work hypothesis.

Module III

Research design and Methods – Research design – Basic Principles – Need of research design – Features of good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan – Exploration, Description, Diagnosis, Experimentation. Determining experimental and sample designs.

Module IV

Data Collection and Analysis - Execution of Research – Observation and Collection of data – Methods of data collection – Sampling Methods – Data Processing and Analysis strategies – Data Analysis with Statistical Packages – Hypothesis – testing – Generalization and Interpretation.

Module V

Reporting and Thesis Writing - Structure and components of scientific reports – Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables – Bibilography, referencing and footnotes – Oral presentation – Planning – Preparation Practice – Making presentation – Use of visual aids – Importance of effective communication.

Text Books:

1. Research Methodology – Methods and Techniques by C.R. Kothari
2. Research Methods – William M.K.Trochim

ECE901: Advance Structural Analysis

Module I

Introduction: A brief history of FEM, Need of the method, Review of basic principles of solid mechanics – principles, equations of equilibrium, boundary conditions, compatibility, strain – displacement relations, constitutive relationship.

Module II

Introduction: Basic wind speed, Design wind speed, Design wind pressure, offshore wind velocity, Wind pressures and forces in buildings/ structures. External pressures coefficients for various roofs, Dynamic effects. Design of Tall Buildings: Analysis of tall building for lateral loads, cantilever method, Portal method, Factor method; Design of structures for wind; Computer application in analysis & design.

Module III

Concepts of Structural Safety: General, Design methods. Basic Statistics: Introduction, Data reduction, Histograms, Sample correlation. Probability Theory: Introduction, Random events, Random variables, Functions of random variables, Moments and expectation, common probability distribution, Extremal distribution, Histograms, Normal distributions and Non-normal distributions.

Module IV

Introduction: Mass- spring-damper idealization of structural systems, equation of motion for SDOF system, solution of the differential equations viscous damping, dry friction damping and negative damping, under-damped, critically damped and over-damped systems, logarithmic decrement, determination of damping in the system

Module V

Earthquake Forces and Structural Responses: Introduction, Bureau of Indian Standards for earthquake design, Earthquake magnitude and intensity, Historical development, Basic seismic coefficient and seismic zone factors, determination of design forces, Choice of method for multi-storied buildings, Difference between wind and earthquake forces, Partial safety factors for design, Distribution of seismic forces, Analysis of structures other than buildings.

Text Books:

1. P.Zienkiewiez, “The Finite Element Method in Engineering Science”, McGraw Hill, 1972.
2. R.Park&T.Paulay, “Reinforced Concrete Structures”, John Wiley & Sons, 1975.
3. R. Ranganathan, “Structural Reliability Analysis and Design”, Jaico Publishing House, Aug2006
4. John M. Biggs, “Introduction to Structural Dynamics”, 1st Edition, McGraw Hill Inc., 1965
5. P.C.Varghese, “Advanced Reinforced Concrete Design”, 2nd Edition, Prentice Hall of India, 2005.

ECE 902: ADVANCED CONCRETE TECHNOLOGY

Module I

Cement: Historical note, Chemical composition, Hydration of cement, Microstructural developments due to hydration and their effects on mechanical and material properties ,Setting, Fineness of cement, Structure of hydrated cement, Different grades of cement, Tests on properties of cement.

Module II

Properties of aggregates: General classification of aggregates, Classification of natural aggregates, Sampling, Particle shape and texture, Bond of aggregate, Strength of aggregate, Other mechanical properties of aggregate, Specific gravity, Bulk density, Bulking of fine aggregate, Deleterious substances in aggregate, Soundness of aggregate, Alkali-silica reaction, Sieve analysis, Grading requirement, Practical grading. **Recycled aggregate**: types, Properties of recycled aggregates, Properties of concrete made with recycled aggregate, limitations and advantages.

Module III

Fresh concrete: Process of manufacture of concrete – Method of transportation, Placing and curing of concrete. Quality of mixing water.Properties of fresh concrete, Workability, Factors affecting workability, Measurement of workability.Definitions of segregation, bleeding and honey combing.

Admixtures: Benefits of admixtures, types of admixtures, supplementary cementing materials, accelerating admixtures, retarding admixtures, water-reducing admixtures, Superplasticizer, special admixtures.

Module IV

Strength of concrete: Water/cement ratio, effect of age on strength of concrete, relation between compressive and tensile strengths, bond between concrete and reinforcement. Testing of hardened concrete: Tests for compressive strength, effect of condition of specimen and capping, comparison of strengths of cubes and cylinders, tests for strength in tension, flexure test, split tension test, accelerated curing test. Definitions of Modulus of Elasticity, creep, shrinkage and Poisson's ratio. NDT tests-UPV, Rebound hammer, Carbonation.

Module V

Durability: Introduction, Physical properties of concrete related due to durability; Resistance to destructive agents: Corrosion, carbonation, chloride ingress, sulfate attack, acid attack, alkali silica reactions; Codal provisions on Durability.

Behaviour of concrete members for fire resistance: Behaviour of hardened cement paste and aggregate under high temperature, Effect of high temperature on concrete, , Effect of high temperature on different types of structural members, Assessing damage, repair, improving performance, temperature tests on specimen (stressed/ unstressed).

Text Books:

1. P K Mehta and Paulo. J.M.Monteiro, Concrete Microstructure , Properties and Materials, Third Edition.
2. A M Neville, Properties of Concrete.
3. M S Shetty, Concrete Technology, S.Chand& Company Ltd., Reprint, 2008.

ECE 903: SURFACE WATER AND GROUND WATER HYDROLOGY

Module I

Hydrology and Precipitation : Global water budget –Rainfall Hyetograph – Intensity Duration and Frequency analysis – Statistical analysis of rainfall data – **Infiltrarion:** Evapotranspiration – Field Measurement – Empirical Equations - Infiltration – Infiltrometers – Infiltration Equations - Infiltration Indices.

Module II

Runoff and Water Conservation : Concept of catchment – Linear, Areal and Relief Aspects – Detailed study of Runoff process – Factors affecting Runoff – Hydrograph – Unit Hydrograph – Synthetic Hydrograph – Runoff estimation - Strange and SCS methods.

Module III

Groundwater Hydraulics : Groundwater Movement - Darcy s law and its limitations – Discharge and draw down for various condition of groundwater flow - Principles of groundwater flow and its equation – Dupuit – Forchheimer assumptions – Influent and Effluent streams - Evaluation of well loss parameters – Interference of wells.

Module IV

Pumping Test Analysis : Determining aquifer parameters for unconfined, confined aquifers – steady and transient conditions - Slug test – Locating hydro geological boundaries – Image well theory – Determination of well characteristics and specific capacity of wells – Well characteristics of large diameter wells.

Module V

Special Topics : Water Conservation – Rain water and Runoff Harvesting in Rural and Urban Areas - Methods of artificial groundwater recharge – Groundwater Basin Management and conjunctive use - Groundwater assessment and balancing – Regional Groundwater Modeling.

Text books:

1. Chow V.T., Maidment D.R., Mays L.W., “Applied Hydrology”, McGraw Hill Publications, New York, 1995.
2. Subramanya K., “Hydrology,Tata McGraw Hill Co., New Delhi, 1994.

3. Jeya Rami Reddy.P, “Hydrology, Laximi Publications, New Delhi, 2004
4. Todd D.K., “Groundwater Hydrology”, John Wiley & Sons, Inc, New York, 1976.
5. Bear J., “Hydraulics of Groundwater”, McGraw-Hill, New York, 1979.
6. Bouwer H., “Groundwater Hydrology”, McGraw-Hill, New York, 1978.
7. A.K. Rastogi, “Numerical Groundwater Hydrology”, 2011

ECE904: TRAFFIC ENGINEERING

Module I

Traffic Characteristics: Physical, Physiological, Psychological, Environmental Characteristics, Traffic Stream Characteristics, Vehicle Characteristics – Static and Dynamic, Urban Road and Road Characteristics – Geometric Design – An Overview

MODULE II

Surveys and Studies in Traffic Engineering: Conventional and Modern Methods of Traffic Survey and Studies – Volume and Capacity – Headway concepts and applications – Speed and Delay – Origin and Destination, Parking, Accident – Level of Services (LoS)

Module III

Design Of Transport Infrastructure: Sight Distance, Design of Cycle Tracks, Pedestrian Facilities, Parking Facilities – On Street, Off Street Multi level Street Lighting

Module IV

Intersection Design: Design of Intersection – At grade intersection – Uncontrolled, Channelization, Rotary, Traffic Signal Control, Signal Co-ordination, Grade Separated Intersection - Types and Design

Module V

Traffic Operation and Management: Traffic Sign, Road Markings, Traffic Control Aids, Street furniture, Road Arboriculture – Traffic Regulation, Cost Effective Management Measures – Traffic Systems Management and Travel Demand Management - Congestion Management, Traffic Calming and Pricing

Text Books:

1. Nicholas T.Garber, Lester A Hoel, “Traffic and Highway Engineering”, Fifth Edition, First Indian Reprint, Cengage Learning, 2015
2. Kadiyali, L.R.,”Traffic Engineering and Transport Planning”, Eighth Edition, Eighth Reprint, Khanna Publishers, 2016
3. Thomas Curinan, An Introduction to Traffic Engineering – A Manual for Data Collection and Analysis, Books Cole, UK, 2001.

ECE905: ENVIRONMENTAL ENGINEERING

Module I

Quality and Analysis of Water: Physical, Chemical and Biological. Drinking water quality standards.Treatment of Water : Flowchart of water treatment plant, Treatment methods (Theory and Design) - Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration, Chlorination and other Disinfection methods, Softening of Water.

Module II

Air Pollution Control Methods and Devices : Air Pollution – sources of pollution – Classification – effects on human beings, Plants and Materials – Global effects of Air pollution – Air emissions standards.Air pollution Control Methods–Particulate control devices – Control of Gaseous Emission.

Module III

Industrial Waste Water Treatment: Theories industrial waste treatment – Volume reduction – strength reduction – Neutralization – Equalization – Proportioning – Nitrification and Denitrification – Removal of Phosphates – Effluent standards.

Module IV

Urban Solid Waste Management: Sources; Quantities and characteristics; Classification; Collection and transportation; Recovery and reuse; Treatment methods such as compositing, incineration, sanitary landfill and pyrolysis.

Module V

E-Waste management E-waste : Sources- Types- components; Collection process- Segregation-Disposal methods; Effect on air, water and soil; Health hazards; Role of individual for E-waste management. Current E-waste Management Rules.

Text Books:

1. Water Supply and Sanitary Engineering by G.S. Birde; Dhanpat rai and sons, Delhi.
2. Environmental Engineering vol. II – Sewage disposal and air pollution engineering by S. K. Garg; Khanna Publishers, Delhi.
3. Air Pollution and Control by MN Rao &H.N.Rao.
4. Environmental pollution control engineering by C. S. Rao; Wiley Eastern Limited, New Delhi.

5. Solid and Hazardous Waste Management by Prof. M.N. Rao and Dr.Razia Sultana, Hyderabad.
6. E-waste: Implications, regulations, and management in India and current global best practices, TERI, Publications, New Delhi.

ECE 906: GEO-ENVIRONMENTAL ENGINEERING

Module I

Soil formation and composition: Introduction- Soil Formation- Phase Composition-Solids Composition and Characterization-Mineral Composition-Role of Composition in Engineering Behavior of Soils

Module II

Soil structure: Introduction-Different Scales of Soil Structure-Pore Sizes Associated with Soil Structure-Single-Particle Arrangements; Gouy-Chapman Theory of the Double Layer; Forces of Interaction between Clay Particles; Role of Soil Structure in the Engineering Behavior of soils, soil fabric.

Module III

Adsorption and soil reaction: Types of adsorption - adsorption characteristics - forces of adsorption; adsorption of water. Acid –base chemistry, charge in soil clays, and formulation of soil acidity and alkalinity. Chemistry of soil weathering.

Module IV

Ground improvement: Need and objectives of ground improvement; Emerging trends in ground Improvement. Stabilisations with admixtures like cement, lime, calcium chloride, fly ash and bitumen.

Module V

Geosynthetics: Introduction: An overview on the development and applications various geo-synthetics - the geo-textiles, geo-grids, geo-nets, geo-membranes and geo-composites.

Text Books

1. KIM H.Tan - Principles of Soil chemistry - Makcel Dekker Ink, fourth edition,2017
2. Donald L.Sparks- Environmental Soil chemistry - 2013.
3. Lakshmi N. Reddy, Hilary. I. Inyang – Geo-Environmental Engineering –Principles and Applications – Makcel Dekker Ink, 2013.
4. P. Purushothama Raj, “Ground Improvement Techniques” Laxmi Publications (P) Limited, 2015.
5. Jie Han et. al., “Advances in ground Improvement” Allied Publications, 2011.
6. R. M. Koerner, “Designing with geosynthetics”, Pearson Education Inc., 2015

ECE 907: GROUND IMPROVEMENT TECHNIQUES

Module I

Role of ground improvement in foundation engineering, methods of ground improvement, geotechnical problems in alluvial, laterite and black cotton soils, selection of suitable ground improvement techniques based on soil condition.

Module II

Insitu Treatment of Cohesionless and Cohesive Soils: Insitu densification of cohesionless and consolidation of cohesive soils, dynamic compaction and consolidation, vibrofloation, sand pile compaction, preloading with sand drains and fabric drains, stone columns, lime piles, installation techniques only - relative merits of various methods and their limitations.

Module III

Grout Techniques: Types of grouts, grouting equipment and machinery, injection methods, grout monitoring, stabilization with cement, lime and chemicals, stabilisation of expansive soils.

Module IV

An Overview of Geosynthetics: Description of Geosynthetics, Properties and Functions Geosynthetics in Ground Improvement: Drainage, PVDs, French Drains, etc.

Module V

Soil Reinforcement: Mechanism, Reinforced slopes, Embankments on soft ground, Reinforced Embankments, Reinforced soil walls and Slope stabilization.

Text Books:

1. R.M. Koerner, Construction and Geotechnical Methods in Foundation Engineering, Tata McGraw Hill, 1994.
2. R.P. Purushothama, Ground Improvement Techniques, Tata McGraw Hill,1995.
3. Rao, G. V. & Raju G. V. S. S. - Engineering with Geosynthetics
4. R.M. Koerner, Design with Geosynthetic, 3/e Prentice Hall, 2002.

References:

1. M.P. Moseley, Ground Improvement Block, IE Academic and Professional, Chapman and Hall, 1993.
2. J.E.P. Jones, Earth Reinforcement and Soil Structure, Butterworths, 1995.
3. R.A. Jewell, “Soil Reinforcement with Geotextiles”, CIRIA special publication,1996. 5. B.M. Das, Principles of Foundation Engineering, Thomson Books / Cole, 2003.

ECE 908: SOIL DYNAMICS AND MACHINE FOUNDATIONS

Module I

Fundamentals of Vibration: Definitions, simple harmonic motion, response of SDOF systems Of Free And Forced Vibrations With And Without Viscous Damping, Frequency Dependent Excitation, Systems Under Transient Loads, Rayleigh's method of fundamental frequency, logarithmic decrement, determination of viscous damping, transmissibility, systems with two and multiple degrees of freedom, vibration measuring instruments.

Module II

Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits attenuation of stress waves, stress-strain behaviour of cyclically loaded soils, strength of cyclically loaded soils, dynamic soil properties, laboratory and field testing techniques, elastic constants of soils, correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand, liquefaction of soils - an introduction and evaluation using simple methods.

Module III

Vibration Analyses: Types, general requirements, permissible amplitude, allowable soil pressure, modes of vibration of a rigid foundation block, methods of analysis, lumped mass models, elastic half space method, elastodynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, vibration isolation.

Module IV

Design of Machine Foundations: Analysis and design of block foundations for reciprocating engines, dynamic analysis and design procedure for a hammer foundation, is code of practice design procedure for foundations of reciprocating and impact type machines, vibration isolation and absorption techniques.

Module V

Machine Foundations on Piles: Introduction, analysis of piles under vertical vibrations, analysis of piles under translation and rocking, analysis of piles under torsion, design procedure for a pile supported machine foundation.

Text Books:

1. I. Chowdhary and S P Dasgupta, Dynamics of Structures and Foundation, 2009.
2. S.D. Arya, M. O'Neil, and G. Pincus, Design of Structures and Foundations for Vibrating Machines, Gulf Publishing, 1979.

References:

1. F.E. Richart, J.R. Hall, and R.D. Woods, Vibrations of Soils and Foundations, Prentice Hall, 1970.
2. Swami Saran, Soil Dynamics and Machine Foundation, Galgotia, 2010.
3. B.M. Das, Principles of Soil Dynamics, 2/e, PWS KENT, 2010.
4. S. Prakash, and V.K. Puri, Foundation for Machines: Analysis and Design, John Wiley, 1998.
5. N.S.V. Kameswara Rao, Vibration Analysis and Foundation Dynamics, Wheeler, 1998. 6. S.L. Kramer, Geotechnical Earthquake Engineering, Prentice Hall, 1996.