Civil Engineering Department

Syllabus of MST-I, II and III

Index

Contents

MTST – 502 Bridge Engineering

MST-I	1. Definitions and components; classification, layout and planning of bridges; introduction to analysis and design of long span bridges like suspension and cable stayed bridges. 2. Site investigations; preliminary data collection; selection of appropriate bridge type; hydraulic design of bridges; traffic design of bridges.
MST-II	1. Analysis and design of superstructure for straight and curved bridge decks-loadings details; specification- reinforced concrete and steel decks, Decks of various types like slab, hollow and voided slab, beam and slam, box girder etc. 2. Analysis and design of foundations - shallow foundations (open Foundations), deep foundations - well foundations and caisson; design and constructional aspects of foundations.
MST-III	1. Latest developments in construction methods for concrete and steel bridges- their impact on the analysis and the design. 2. Inspection and maintenance and rehabilitation of bridges.

MTST – 504 Research Methodology

MST-I	1. OVERVIEW OF RESEARCH Nature and Objectives of research, historical, descriptive and experimental, Study and formulation of research problem, Scope of research and formulation of hypotheses; Feasibility, preparation and presentation of research proposal 2. METHODS OF DATA COLLECTION Primary data and Secondary Data, methods of primary data collection, classification of secondary data
MST-II	1. SAMPLING METHODS Probability sampling: simple random sampling, systematic sampling, stratified sampling, cluster sampling and multistage sampling. Non-probability sampling: convenience sampling, judgement sampling, quota sampling. Sampling distributions 2. PROCESSING AND ANALYSIS OF DATA Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, time series analysis, correlation and regression, Testing of Hypotheses :Parametric (t, z and F) Chi Square, ANOVA. Measures of central tendency and dispersion: mean, median, mode, range, mean deviation and standard deviation. Regression and correlation analysis
MST-III	1. DESIGN OF EXPERIMENTS: Basic principles, study of completely randomized and randomized block designs. Edition and tabulation of results, presentation of results using figures, tables and text, quoting of references and preparing bibliography

MTST – 506 Plastic Analysis and Design of Steel Structures

MST-I	1. Concept of ductility; Behavior of ductile structures; Definition of collapse and characteristics of bending moment distribution at collapse; Fundamental theorems; Simple plastic theory of bending; Concept of plastic hinges and mechanisms; Hinge formation in indeterminate structures, Redistribution of moments, Assumption made for structures subjected to bending only; Concept of loaded factors and ultimate load as design criteria.
MST-II	1. General methods of analysis- load interaction method; analysis by generalized hinge rotation; analysis by combinations of elementary mechanisms; analysis by adjustment of restraints; plastic moment distribution method; Upper and lower bounds.
MST-III	1. Minimum weight design-Concept, Assumptions, Design of frame with prismatic members; Elements of linear programming and its application to minimum weight design problems. 2. Deflections- Assumption; Calculation of deflection at ultimate loads and permissible values. 3. Concept of shake down analysis and related theorems; applications to simple structural systems.

MTST – 612 Design of Highway and Airport Pavements

MST-I	1. GENERAL CONSIDERATION: Components of road pavement such as subgrade, Sub base, Base course and wearing course and their functions, Comparison of flexible and rigid pavements highway and air port pavements 2. FACTOR AFFECTING THE PAVEMENTS DESIGN: Traffic factor , Moisture and climate factors, Soil factor, Stress distribution factors, Design method of Flexible pavements, General classification of various methods and their approach Empirical methods using soil classification tests, Theoretical and semi theoretical methods, General observation and limitation of various methods
MST-II	1. PAVEMENTS MATERIALS: Stabilizing base viz., Mechanical, Stabilized with admixture like cements, Bitumen lime and other chemicals. 2. DESIGN METHOD OF RIGID PAVEMENTS: Analysis of stresses in concrete pavements due to various wheel loads. Cyclic changes in temperature. Changes in moisture and volumetric change in subgrade and base course, Comparison of analysis of stress due to wheel loads on liquid and solids subgrade theorem, Thickness design methods such as P.C. A. design method F.A.A. methods etc., Design of distributed steel reinforcement design of dowels, Design of spacing of joints
MST-III	1. PAVEMENT EVALUATION AND STRENTHENING: Method of pavement evaluation including LCN method for airport, Design of various type of overlays for flexible and rigid pavements, Mechanics of pumping and blowing, Factor affecting pumping, preventive measures. 2. PAVMENTS PERFORMANCE: Pavements performance, Road Mechanic and their applications, The AASHO road test, Evaluation of performance of the flexible and rigid pavements, Analysis of results from flexible and rigid pavements

MTGT – 502 Advanced Foundation Engineering

MST-I	1. Shallow Foundation: Terzaghi's bearing capacity equation, General bearing capacity equation, Balla's & Meyerhof's theory, Effect of water table, special footing problems, I.S. Code, Footing pressure for settlement on sand, Soil pressure at a depth, Boussinesq's & westergaard methods, Computation of settlements (Immediate & Consolidation) Permissible settlements, Proportioning of footing, Inclined & Eccentric loads. 2. Pile Foundation: Timber, concrete, Steel piles, estimating pile capacity by dynamic formula, By wave equation & By static methods, Point Bearing piles, Pile loads tests, Negative skin friction, Modulns of subgrade reaction for laterally loaded piles, Lateral resistance.
MST-II	1. Single Pile v/s Pile Groups, Pile group consideration, Efficiency, Stresses on underlying strata, Settlement of pile group, Pile caps, Batter piles, Approximate and exact analysis of pile groups, I.S code. 2. Well foundation: Types (open end & closed or box, pneumetic, drilled) shapes, Bearing capacity and settlements, Determination of grip length by dimensional analysis, Design of well foundation construction, Tilts & shifts.
MST-III	1. Machine Foundations: Types, Analysis and design by Barkens methods, Determination of coeff. of uniform elastic compression, Pauw's analogy and design of a Block type M/C foundation, I.S.I method of design, Co-vibrating soil mass. 2. Sheet Pile Structure: Types, Cantilever, Anchored sheet piling , Design by Fixed earth Method and modifications by Anderson & Techabotarioff, Anchor Braced sheeting cofferdam , Single well cofferdams, Cellular cofferdam, Stability of cellular cofferdam, Instability due to Heave of bottom.

MTGT – 505 Analysis of Settlement of Soils and Foundations

MST-I	1. Stress Strain Relation; Evaluation of parameters, types of settlements- elastic and inelastic, Method for estimation
MST-II	1. Consolidation theories- one and three dimensional. Settlement of footings- isolated footings, strip footing, Rafts
MST-III	1. Piles and piles groups, Analysis of foundation Soil system

MTGT – 620 Highway Materials and Construction

MST-I	1. Subgrade Soil:- significance, characteristics of soil, desirable properties, Index Properties, Soil classification based on grain size, IS soil classification, GI of soil, Subgrade strength, Evaluation of soil strength- Direct Shear Test, Triaxial Comp. test, UCS test, plate bearing test, Modulus of subgrade reaction, CBR Test 2. Stone Aggregates:- Introduction, desirable properties, crushing test, impact test, soundness test, shape test, specifics gravity & water absorption, bitumen adhesion test 3. Bituminous Materials:- Introduction, types of bitumen materials, desirable properties, penetration test, ductility test, viscosity test, float test, specific gravity test, softening point test, flash & fire point test, solubility test, spot test, loss on heating test, water content test, Cutback bitumen, bitumen emulsion, tar
MST-II	1. Bituminous Paving Mixes:- Requirements of bituminous mixes, design of bituminous mix, Marshall Method of bituminous mix design, modified Hubbard field method of bituminous mix design, Hveem method of bituminous mix design
MST-III	1. Bituminous Pavement Construction:- Introduction, types of pavement construction, excavation equipments, embankment construction, preparation of subgrade, compaction equipments, field control for compaction, construction of earth roads, construction of gravel roads, construction of WBM roads, construction of bituminous pavements, Bituminous construction procedures 2. Cement Concrete Pavement Construction:- Introduction, Mix design, concrete strength, size of aggregates & gradation, workability, construction of cement concrete pavement slab, construction of joints, joints filler & sealer, prestressed concrete pavements

MTEV – 503 Biological Treatment Methods

MST-I	1. Wastewater Characteristics and Effluent Standards: Physical, chemical and biological parameters of water pollution, Solids (volatile and non-volatile solids; suspended, dissolved and colloidal solids), Biodegradable and non-biodegradable organic matter (DO, COD, BOD and BOD kinetics), Nutrients (TKN, total nitrogen, and total and ortho-phosphorus), Sulfides, phenols, cyanides, heavy metals, Effluent Standards. 2. Process Kinetics: Fundamentals of Process Kinetics, Zero order, First order, Second order Reactions, Enzyme reactions
MST-II	1. Bio reactors- Types-Classification – Design principles. 2. Attached Growth Processes: Trickling Filters (Standard Rate, High Rate), Practices, Features and Design, Operational Difficulties and Remedial Measures, Rotating Biological Contactors. SAF, FAB and MBBR technologies. 3. Suspended Growth Processes: Activated Sludge Process, Modifications including SBR and Design Equations, Process Design Criteria, Oxygen and Nutrient Requirements. 4. Waste stabilization Ponds and Lagoons: Aerobic pond, facultative pond, anaerobic ponds, polishing ponds, aerated lagoons.
MST-III	1. Constructed wetlands and Duckweed ponds. 2. Anaerobic processes-Process fundamentals-Standard, high rate and hybrid reactors. Anaerobic filters-Expanded /fluidized bed reactors-Upflow anaerobic sludge blanket reactors, Design and Operation. 3. Sludge Treatment and Disposal: Sludge Thickening, Sludge Digestion & disposal. 4. Other Treatment Technologies: Advanced oxidation processes, Biological nutrient removal.

MTEV – 506 Air Pollution and Control

MST-I	1. Air pollutants – Sources and classification of pollutants and their effect on human health, vegetation and property- Effects - Reactions of pollutants and their effects-Smoke, smog and ozone layer disturbance - Greenhouse effect – Ambient and stack sampling. 2. Atmospheric Phenomena - Dynamism of atmosphere, Energy balance of atmosphere, Meteorological aspects, Wind and wind roses, Environmental and adiabatic lapse rates, Derivations of DALR, WALR and ELR, Atmospheric stability, Factors influencing stability, Temperature inversions, Mixing height.
MST-II	1. Atmospheric diffusion of pollutants - Transport, transformation and deposition of air contaminants - Air sampling & pollution measurement methods - Ambient air quality and emission standards, Modelling-Gaussian model and equation, Air quality index. 2. Particulate emission control- Settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators.
MST-III	1. Control of gaseous pollutants – Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. 2. Biological air pollution control technologies – Bio-scrubbers, bio-filters, and Indoor air quality.

MTEV – 620 Pollution Monitoring Techniques

MST-I	1. Analytical methods: Gravimetric analysis, volumetric analysis, precipitation methods, oxidation reduction methods.
MST-II	1. Principle, brief working and applications of different instrumental methods: U V I R spectrophotometer, flame photometry, AAS
MST-III	1. Chromatography, gas chromatography, Liquid chromatography , polarography, mass spectrometry, NMR & ESR spectroscopy, radio activity measurement, x-ray diffraction, thermal analysis techniques: DTA, TGA, DSC