I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY

Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. 1 of 1997)

Ref. No. : IKGPTU/Reg/N/ *Dated :*

NOTIFICATION

Sub: **Regarding Pre-Ph.D Course work.**

This is for information of all concerned that Pre-Ph.D course work from 2016-17 will be conducted in the IKGPTU main campus Kapurthala in regular mode. The PhD course work will consists of minimum 15 credits. The structure of the course work is as under.

Sr. No.	Nature of course	Name of course	Credits	Remarks
1.	Core	1.Research Methodology	4	The syllabus of RM should be formulated faculty wise such as Engineering, Science, Management/ Humanities and Life sciences
		2.Subject related theory paper	4	Discipline specific related to advancements in theoretical methods for research
		3. Presentation	3	Discipline specific
2.	Interdisciplinary	4. Elective	4	From list of subjects from allied fields
	Total Minimum credits		**15**	

-Sd-
Registrar

Endorsement No: IKGPTU/REG/N/ 4244-4251 Dated: 22.08.2016

1. Secretary to Vice Chancellor: For kind information of Vice Chancellor
2. Dean (P&D)
3. Dean (RIC)
4. Dean (Academics)
5. Finance Officer
6. Controller of Examination
7. DR (Computers): For uploading on website
8. File Copy

Registrar 22/8/16

I. K. Gujral Punjab Technical University, Jalandhar
Jalandhar Kapurthala Highway, Near Pushpa Gujral Science City, Kapurthala - 144 603
Ph. No. 01822 - 662521, 662501 Fax No. : 01822-255506, 662526. Email : registrar@ptu.ac.in

Civil E

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Pre Ph.D. Course in Civil Engineering

Schematic and Syllabus

Sr. no.	Nature of Course	Name of course	Credits	Remarks
1.	Core	Research Methodology	4	The syllabus of RM should be formulated faculty wise
		Discipline Specific subjects	4	1.Transportation and Highway Technology 2. Foundation Design and Construction 3.Environment Engineering and Management 4.Pavement Design, Construction and Maintenance 5.Bridge Engineering 6.Advanced Construction Technology 7.Advanced Structural Engineering 8.Hydraulics Engineering 9.Geotechnical Engineering
		Presentation	3	Discipline specific
2.	Interdisciplinary	Elective	4	From list of subjects from allied fields 1.Town and Country Planning 2.Advanced Geoinformatics 3.Computer Aided Design Methods 4. Civil Engineering applications of Remote sensing and GIS
	Total Minimum credits		15	

Paper Title: Research Presentation

L T P

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Research Scholar will have to present a seminar based upon his/her research area. Performance of the scholar and participation in seminar will be taken into consideration.

Pre Ph.D. Course in Civil Engineering

Research Methodology

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1. Introduction Research Methodology: Definition of Research, Need of Research, Concept and steps of Research Methodology , Uses of Research Methodology, Research Techniques. Reviewing Literature: Need, Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review.

2. Identifying and defining research problem: Locating. Analyzing stating and evaluating problem, Generating different types of hypotheses and evaluating them.

3. Data collection: Static and dynamic characteristics of instruments used in experimental set up, calibration of various instruments, sampling methods, methods of data collection, Selection of Appropriate Method for Data Collection, Data collection using a digital computer system, case studies of data collection

4. Data Analysis: Data processing, data analysis strategies and tools, data analysis with statistical packages, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation Applied statistics: Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis Software tools for modeling, Simulation and analysis

5. Research reports and Thesis writing: Introduction: Structure and components of scientific reports, types of report, developing research proposal. Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, word processing tools such as Latex Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

6. Research ethics, IPR and publishing Ethics: ethical issues. IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Books:

1. C.R. Kothari, "Research Methodology – Methods and Techniques", Wiley Eastern Ltd 2009.

2. B.L. Wadehra, Law relating to patents, trademarks, copyright designs and geographical indications, Universal Law Publishing, 2014.

3. K. N. Krishnaswamy, Appa Iyer Sivakumar, M. Mathirajan," Management Research Methodology: Integration of Methods and Techniques, Pearson, 2006 4. S.P Gupta,"Statistical Methods", Sultan Chand & Sons, 2006.

Pre Ph.D. Course in Civil Engineering

Transportation and Highway Technology

L	T	P
4	0	0

1. HIGHWAY MATERIALS Soil stabilization types, source, functions, requirements, properties, tests and specifications for use in various components of road, Soil compaction for use in fill and subgrade of roads. Soil stabilization – principle, methods and tests, proportioning of materials and mix design, application of Rotchfutch method. Marginal and waste materials in road construction, properties and scope in road construction. Bituminous Material (properties of the material) and marshall mix design (both wet and dry), Usage of Geosythentics and Geotextiles in construction of highways.

2. HIGHWAY CONSTRUCTION AND MAINTENANCE Components of road and pavement structure functions, requirements and sequence of construction operations. Plants and equipment for production of materials, Road construction equipment, Pre-construction surveys and marking on ground, Different types of granular base course, Different types of sub-base, Road maintenance works and quality control tests as per MORTH specification. SPECIAL PROBLEMS IN ROAD CONSTRUCTION Problems on construction on areas with marshy and weak soils, expansive clays and' water- logged – areas. Design and construction of filter drains and capillary cut-off. Vertical sand drains – application, design and construction method. Road construction on desert region and coastal areas.

3. ROAD SAFETY AND MANAGEMENT Road accidents, causes, scientific investigations and data collection. Road safety issues and various measures for road safety. Engineering, education and enforcement measures for improving road safety. Short term and long term measures. Traffic management techniques. Evaluation of the effectiveness and benefits of different traffic management measures, management and safety practices during road works. Economic evaluation of roads.

4.TRAFFIC SURVEYS & APPLICATION OF REMOTE SENSING AND GIS IN HIGHWAY ENGINEERING Traffic studies- Trip distribution, generation assignment and model split (Statistical analysis). Design of the traffic signals at urban intersections. Level of service at intersections. Design of parking in urban areas and problems Concepts, components, working of GIS, data capture, data integration, data structures. Coordinate systems and map projections, Registration. GIS analysis and tasks – Input, manipulation, management, query and analysis, visualization, proximity analysis, overlay analysis, GIS and Remote sensing data integration. Overview of image processing softwares and GIS softwares, Introduction to GPS and its application (includes the recent software's used in the highway engineering)

Books:

1. MoRTH 'Specifications for Roads and Bridges Works'- Indian Roads Congress.

2. IS 73, revised 2006, IS 2720, IS 2386, IS 1201 to 1220, IS 8887- 1995, IS 217- 1986.

3. IRC -37, IRC -58 , IRC: 42-1994, IRC:15-2002, IRC SP :11-1988, , 55-2001, 57-2001,58-2001, IRC 19-1977, 27- 1967, 29-1988, 34-1970, 36- 1970,48-1972,61-1976, 63-1976, 68-1976, 81-1997,82-1982, 84-1983,93-1985, 94- 1986, 95-1987, 98-1997, 105-1988

4. Peurifoy, R.L., and Clifford,JS "Construction Planning Equipment and Method"- McGraw Hill Book Co. Inc.

5. Freddy L Roberts, Prithvi S Kandhal et al, "Hot Mix Asphalt Materials, mixture design and construction"- (2nd Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA

6. Leonards G. A. "Foundation engineering" - McGraw Hill Book Company, New York, 1962

Pre Ph.D. Course in Civil Engineering

Advanced Foundation Design and Construction

L	T	P
4	0	0

1. General Principles of Foundation Design : Functions of foundations, essential requirements of a good foundation, types of foundations, principal modes of failure, estimation of allowable bearing pressures, calculation of ultimate bearing capacity by theoretical and empirical methods: Terzaghi's Method, Skempton's analysis for clays, Mayerhof's analysis BIS Method (IS:6403), Settlement of foundations. Factors to be considered foundation design, numerical problem based in BIS method.

2. Pile Foundations : Purpose/uses of pile foundations, Classification of piles based on different criteria, Brief details of timber, concrete, steel piles their advantages and disadvantages , selection of pile type, pile action, behaviour of pile and pile groups under load. definition of failure load. Estimation of carrying capacity : Single driven pile in cohesion less soils - methods based of on SPT and CPT, ultimate load on driven and cast-in-place piles and bored and cast-in-place piles in cohesionless soils. Factors affecting pile capacity.- Numerical problems Ultimate capacity of single pile driven in cohesive soils; modification for driven and cast-in-place piles and bored and cast-in-place piles. Capacity of very long piles – Numerical problems Carrying capacity of piles on rocks.

3. Well Foundations: Basic Principles, Forces acting on Well foundations, Sinking of Wells, Tilts and Shifts. Soil Stability: Retaining walls – Introduction, types, Principles of design, Modes of failure, drainage of the back fill, problems related to design of gravity retaining wall and stability of retaining walls.. Unbraced excavations, braced excavations. Sheet piles - types anchors and tie backs. Shoring and Underpinning - necessity and methods

4. Improvement of Foundation Soils Purpose : (a) Improvement of granular soils : term used to describe degree of compactness – relative density, density ratio and degree of compaction; Methods - Vibration at ground surface, factors influencing roller compaction; deep dynamic compaction, vibro-compaction impact at depth. (b) Improvement of cohesive soils : preloading, or dewatering, methods of installing sand drains ,drain wicks, electrical and thermal methods. Grouting : purpose, functions, types of grouts ; soil bentonite - cement mix, cement mix, emulsions, solutions: grout injection methods. Geo-synthetics : types, functions, manufacturing of geo-textiles , Classification of geo-textiles. Specific Applications : Bearing capacity improvement, reinforcement, retaining walls, embankment etc. testing of geo-synthetics, usage in India and a case study.

5. Special Considerations in Foundation Design and Construction: Elementary principles of design and construction of foundations subjected to earthquake or dynamic loads, special measures for foundations constructed under water.

Books :

1. Tomlinson MJ, Foundation Design and Construction , ELBS-Longman, 6e,.

2. Bowles Joseph E, Foundation Analysis and Design, McGraw Hill.

3. Som, NN & Das S.C. , Theory and Practice of Foundation Design, Prentice Hall of India, 2003

4. Braja M. Das, Principles of Foundation Engineering, 6e, Thomson, 2007

5. Koerner, Robert M, Construction and Geotechnical Methods in Foundation Engineering , McGraw Hill,

6. Dinesh Mohan, Pile foundations, Oxford & IBH, 1998

7. Kurian, N.P. Modern Foundations, Tata McGraw Hill, 1982.

8. Fang H.Y. Foundation Engineering Handbook, Van Nostrand Reinhold, 23, 1991.

9. Kaniraj Shenbaga R, Design Aids in Soil Mechanics and Foundtion Engineering, Tata McGraw Hill,

Pre Ph.D. Course in Civil Engineering

Environment Engineering and Management

L	T	P
4	0	0

1. Environment & Ecology: Definition and understanding of concepts, ecosystem, energy flow in ecosystem, water, carbon and nitrogen cycle, community's inter-relationships in an ecosystem. Importance of clean environment.

2. Type of Pollutants and Protection of Environment :Water Pollution : Sources, causes and measurement of water pollutants in surface and ground water, water quality criteria for various uses of fresh water, river basin studies for surface water pollution control, biochemical oxygen demand, effect of oxygen demanding wastes on rivers. Domestic and industrial Pollution : Sources, Standards for disposal of waste water and industrial effluents, basic unit operations in control of waste water pollution, C.P.C.B./M.O.E.F. for abatement of Industrial Pollution and Pollution Control/Treatment methods and technologies.

3. Air Pollution : Definition, principle materials causing pollution, types of air contaminants, their sources and ill effects on living and nonliving materials, permissible limits. air pollution control - basic principles, natural self cleansing, pollution control methods and various engineering devices to control particulate and gaseous pollutants, controlling air pollution from automobiles. Noise Pollution : Definition, sources of noise and its units, adverse effects of noise pollution, sound pressure level and its measurement, octave band and its importance; noise pollution control measures. Solid Waste Pollution: Sources, effects and treatment of solid wastes.

4. Degradation of Land Resources : 3.1 Deforestation and Wetlands : Forest land, deforestation and its effects on land use and environmental quality, wetland and their importance in environment, causes and extent of wasteland, Soil degradation problems, erosion, salinization, water logging, land use management & planning.

Land Fills: Sitting Criteria, Waste containment Principles, types of Barrier materials, Planning and Design aspects relating to Waste disposal in landfills, Control and remediation of sub surface contamination. Case studies

5. Current Issues in Environmental Engineering : Global warming, ozone depletion, acid rain, oil pollution, radiation hazard and control, role of non- conventional sources of energy in environment.

6. Environment Impact Assessment : Definition and its importance for environment management, constituents of environment impact assessment , project data for EIA study, prediction of impacts, EIA methodologies, constraints in implementation of EIA, impact prediction on water resources projects and other relevant case studies. Environment pollution.

7. Environmental Management System: Main clauses and basic steps for certification. Water pollution, air pollution and EPA and their salient features.

Books:

1. Peavy,Rowe,,Techobanoglous, Environmental Engg. Tata McGrawHill.

2. Mackenzie L Davis, Environmental Engg. Tata McGrawHill.

3. Baljeet S. Kapoor; Environmental Engg. An overview, Khanna Publishers.

4. Glbert H.Masters , Environmental Engineering and Science, Prentice Hall of India Pvt.Ltd.

5. GN Panday, GC Carney Environmental Engineering,Tata McGrawHill.

6. P.D. Sharma, Ecology and Environment Rastogi Publications.

7. Ray P.A Lcances Environmental Impact Assessment Hand Book, National Environmental Protection Council Manila.

8. P Venugopala Rao ; Text Book of Environmental engineering, PHI

Pre Ph.D. Course in Civil Engineering

Pavement Design, Construction and Maintenance

L	T	P
4	0	0

1. Introduction: Types of pavement structure, functions of pavement components. factors affecting pavement design. Design of Pavements: Methods for design of flexible pavements: CBR , Group Index Method , California bearing value method , Triaxial test method , Burmister method , McLeod's method.

2. Design considerations, methods for design of rigid pavements: Westergaard's method, F.A.A. method, types of joints and their design in cement concrete pavments. Thickness design for Airport pavement ,FAA method for Flexible and Rigid pavements, ESWL Concept , CBR method (USACE) , LCN system of pavement design,

3. Construction of Highways: Types of Highway Construction and their selection, materials for construction, construction procedure of different highways: Gravel roads, WBM , W.M.M., Bituminous pavements, cement concrete pavements, Joints in cement concrete pavements, introduction to various Equipment used for highway construction. Constructional features for Pre-Mix Carpet, Mix Seal Surfacing , B.M. , SDBC. Other higher quality pavement layers – DBM , BC (introduction only)

4. Maintenance of Highways: Pavement failures, their causes and remedial measures typical flexible and rigid pavement failures, types of highway maintenance: routine, periodic and special type, materials used for maintenance of different pavement such as bituminous pavements, cement concrete road, Slurry Seal, Liquid Seal, Fog Seal, Patching Defects/ Failures in Flexible Pavement- their types and causes, Remedial Measures Surface defects, Cracks, Deformation, disintegration, Cracks, Spalling , Slab Rocking , Joint Sealant Failure and Rectification

Books:

1.. Khanna and Justo ; Highway Engineering, Nemchand & Bros. Roorkee

2. Clarkson H.Oglesby and Gary Hicks; Highway Engineering. John Wiley & Sons, London,

3. Rao ; Airport Engineering , Tata McGraw Hill Publishing Co. New Delhi

4. Khanna and Arora.; Airport Planning and Design

5. Wright and Paquette; . Highway Engg , John Wiley and Sons, New York

6. Vaswani, Highway Engg Roorkee Publishing House, Roorkee

7. Sharma and Sharma.; Principles and Practices of Highway Engg., Asia Publishing House, New Delhi .

Pre Ph.D. Course in Civil Engineering

Bridge Engineering

L	T	P
4	0	0

1. Introduction Definition; components of a bridge; classification; importance of bridges.
2. Standard Specifications for Road Bridges: Indian Roads Congress Bridge Code; width of carriageway; clearances; loads to be considered; dead load; I.R.C. standard live load; impact effect; application of live load on decks; wind load; longitudinal forces; centrifugal forces; horizontal forces due to water current; Buoyancy effect ; earth pressure ; temperature effects ; seismic force.

3. Reinforced concrete Bridges : General arrangement and suitability : T-beam bridges; Balanced cantilever bridges ; Continuous girder bridges; Rigid frame bridges; Arch bridges; Steel bridges (Familiarization with MOST specifications and drawings)

4. Sub-Structure : Design of piers and abutments (Masonry & R.C.C).

5. Foundations : Types of foundations; Open; Piled and Well foundations; including construction details. Pile Foundations: Suitable Pile types for bridges, Pile Installation, Carrying capacity of bored and cast- in-situ pile (No numericals) Well Foundations in Components and brief description, Well Cap, Stability of a single well

6. Bearings, Joints, and Handrails : Different types of bearings, joints and handrails.

7. Construction and Maintenance of Bridges, Quality Assurance, Construction Method (brief) Steel bridges, Long span concrete bridge, Traditional method, Incremental Push launching method, Cantilever method, Maintenance, Maintenance of Bearings, Expansion Joints.

Reference Books:

1. Victor Johnson; Essentials of Bridge Engineering , Oxford & IBH Publishing Co, New Delhi.,2007

2. Khadilkar; C.H. , A text book of Bridge Construction, Allied Publisher, New Delhi.

3. Rangwala; Bridge Engg

4. Rowe, R.E., Concrete Bridge Design , John Wiley & Sons, Inc. New York

5. Raina , V.K. , C oncrete Bridges Practice Book , Tata McGraw Hill , New Delhi

6. Jagadeesh, Jayaram : Design of Bridge Structures , Prentice Hall.

7. Raina, V.K. Concrete Bridges Handbook, Galgotia Publications (P) Ltd, New Delhi

Pre Ph.D. Course in Civil Engineering

Advanced Construction Technology

L	T	P
4	0	0

1. Earthen Dams : Introduction, types ,design considerations/aspects to suit available materials, causes of failures , criteria for safe design ,section, d/s drainage system, seepage analysis, stability analysis, stability of d/s slope during steady seepage, stability of u/s slope during sudden draw down, stability of u/s and d/s slopes during construction, stability of foundation against shear, seepage control measures, design considerations in earthquake regions, design of earthen dam. Quality control in construction of embankments - monitoring of post - construction behaviour and instrumentation.

2. Special Foundations : Foundations for chimney, cooling towers, telecommunication/ transmission towers, foundations for underground structures, coastal and off shore structures in different soil conditions, foundations in expansive soils. dewatering and its various methods.

3. High Rise Construction : High rise buildings; architectural & structural aspects; special features of construction; tall chimneys, components, design aspects; slip form method , lift slab method; special problems of high rise construction.

4. Prefabricated Construction : Advantages of pre fabricated construction; selection of structural elements; design aspects; assembly of precast elements; jointing , modular co-ordination and tolerances; structural systems for buildings; single and multi- storey building systems; methods and equipments. For handling and placement. Basic concepts of prestressing.

5. Advanced Construction Materials: Geo-synthetics: Various, types; geo-textiles, geo-grids, geo-membranes, geo- composites functions and general applications, advantages , properties of geo-textiles , epoxy resins, polymers, grouts and anchors, special flooring materials ,sealants and adhesives, protective coatings.

Books :

1) Bharat Singh and Varshney RS , Engineering for Embankment Dams - Oxford and IBH.
2) Sharma RK and Sharma TK ; Dam Engineering - Oxford and IBH
3) RS Varshney, SC Gupta and RL Gupta. Theory and Design of Irrigation Structures
4) Naiman P Kurian , Modern Foundations - Introduction to Advanced Techniques Tata McGraw Hill
5) CBRI Roorkee-Application Potential of Geosynthetics in Civil ngineering, Proceedings of workshop January 4-6,1989 Tata McGraw Hill.
6) Bungale S Taranath; Structural Analysis and Design of Tall Buildings , Tata McGraw Hill

Pre Ph.D. Course in Civil Engineering

Advanced Structural Engineering

L	T	P
4	0	0

1. Three dimensional elasticity problems, Torsion of open section, Thermal Stresses, Fracture mechanics. Kirchoff and Mindlin theory of plates, higher order shear deformation theories, classical theories of skew plates, Shell surfaces, bending theory of shells.

2. Matrix methods of structural analysis and associated computer programme assembly of matrices. Solution equations. Flow charts. Stiffness and flexibility methods for analysis of beans and frames.

3. Finite Element Method, 2D and 3D applications in plane and three dimensional elasticity problems. Analysis of plate and shell structures. Applications using proper software.Nonlinear analysis of structural elements. Material and geometric nonlinearity. Applications for beam, plates and shells.

4. Multi- variable and Multi-objective optimization. Non linear and non traditional techniques of optimization. Design for reliability, reliability based optimization.Stability Analysis: Beam column, buckling of frames. Lateral buckling of beams, torsional buckling, energy criterion and energy based methods, dynamic stability

Books:

1. Timoshenko and Goodier - Theory of Elasticity, McGraw-Hill Publications

2. S. Crandall, N. Dahl and T. Lardner - Mechanics of Solids, McGraw Hill Publications

3. Anil K Chopra – Dynamics of Structures Theory and Applications to Earthquake Engineering, Prentice-Hall Publications

4. R.W Clough and J Penzin – Dynamics of Structures, McGraw Hill Publications

5. R.C. Roy - Structural Dynamics an Introduction to Computer Methods, John Wiley & Sons Publications

6. S. Timoshenko and W. Krieger, Theory of Plates and Shells, Mc Graw Hill.

7. Ansel C. Ugural, Stresses in Plates and Shells, Mc Graw Hill 8. Chandrashekhara K., Analysis of Plates, New Age International Edition.

Pre Ph.D. Course in Civil Engineering

Hydraulic Engineering

L	T	P
4	0	0

1. Water resources systems analysis, design and management for water supply, irrigation, drainage, hydropower, food control, droughts.Surface and ground water hydrology, stochastic hydrology, physical and numerical modeling, use of finite difference, finite element and boundary element methods.

2. Instrumentation and monitoring of hydraulic systems, computer simulation and optimization of hydrosystems.Computational fluid dynamics, coastal hydrodynamics, watershed management, application of numerical methods.

3. Ground water systems planning and management, ground water pollution investigation. Hydroinformatics, multi criterion decision support system, applications of ANN and GA.

4. Hydraulics of spillways and energy dissipators, pressure fluctuations in hydraulic jump, static and dynamic uplift pressures in stilling basins. Remote sensing and GIS applications, Dam break analysis using softwares.

Books:

1. Principles of water resources planning and management – Goodman

2. Applied hydrology – Linsley Kolhar and Paulhas (McGraw Hill)

3. Computational fluid dynamics – Anderson

4. Neural network fundamentals with graphs, algorithms, applications – Bose N.K. and Liang P (McGraw Hill)

5. Practical handbook of GA applications, Vol I – L. Chambers (CRC Press)

-Pre Ph.D. Course in Civil Engineering

Geotechnical Engineering

L	T	P
4	0	0

1. Advanced Geotechnical Engineering Stress distribution under earth embankments and evaluation of settlement profile. Field problems to monitor movement of slopes, foundations, etc. Advanced Foundation Engineering Foundations in difficult soils: expansive soils, chemically aggressive environment, soft soils, fill, regions of subsidence.

2. Rock mechanics and Tunelling Deformation characteristics of rocks and its measurement. Instrumentation, Underground excavation and subsidence. Bearing capacity of homogeneous as well as discontinuous rocks. Soil Dynamics and Geotechnical Earthquake Engineering Soil behaviour under dynamic loads. Seismic response, strong ground motion, its parameters and their estimation, seismic hazard analysis, local site effects and design ground motion, seismic slope stability

3. Finite Element Methods in Geotechnical Engineering Stress deformation analysis: One-, Two, Three-dimensional formulations; Discretization; Analysis of foundations, dams, underground structures and earth retaining structures. Geo environmental Engineering

4. Soil Structure Interaction Elastic and plastic analysis of stress distribution on yielding bases. Analysis of conduits. Interaction analysis of piles and pile groups. Elastic continuum and elastoplastic analysis of piles, Non-linear load-deflection response. Geotechnics for Infrastructure Exploration studies for different Infrastructure Projects, Investigation reports, Analysis and required measures

Books:

1. Aki K and Richards P G (2002), Quantitative Seismology, University Science Books

2. Bowles J E (1996), Foundation Analysis and Design, McGraw Hill.

3. Das B M (1997), Advanced Soil Mechanics, Taylor and Francis.

4. Das B M (1993), Principles of Soil Dynamics, Brooks/Cole

5. Coduto D P (2001), Foundation Design: Principles and Practices, Prentice -Hall

6. Kaniraj S R (1988), Design Aids in Soil Mechanics and Foundation Engineering, Tata McGraw Hill

7. Poulos H G and Davis E H (1980), Pile Foundation Analysis and Design, John Wiley and Sons

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)
Computer Aided Design Methods

L	T	P
4	0	0

1. Introduction to CAD and its scope simple description of computer hardware. - Micro, mini etc. - memory, processor - Peripheral devices-disks, printer. Video terminals. Graphic floater, graphic screen digitizer.

2. Computer Graphics: introduction, point plotting techniques, line drawing displays, two-three dimensional transformation, clipping and windowing, segmentation geometric modeling. Three dimensional graphics, curves and surfaces, hidden surface elimination, shading. Graphic input devices. Graphic input technique, input functions. Raster graphic fundamentals, interactive raster graphics, raster graphic systems.

3. Computer aided linkage displays and synthesis, interactive acceleration analysis. Appreciation of graphic packages.

4. Basics of Design and Analysis Softwares like STAAD PRO, ETABS, ANSYIS, MATLAB.

5. Data base management , storing and retrieving of data

Books:

1. Principles of interactive computer graphics by William M. Newman & Robert F.Sproul.

2. Programming in Finite Element by Hunton and owan

3. Principles of Computer Aided design by Joe Rooney & Philips Steadman

4. Computer Fundamentals-P.K.Sinha, BPB Publications

Civil Engineering applications of Remote sensing and GIS

L	T	P
4	0	0

1. Photogrammetry and Aerial Photogrammetry Photogrammetry- Introduction, basic definitions, terrestrial photogrammetry, phototheodolite, horizontal and vertical angles from terrestrial photographs, horizontal position of a point from photographic measurements. Aerial Photogrammetry- advantages, vertical, tilted and obliquephotographs, geometry of vertical photographs, scale of vertical photographhover flat and variable terrain, ground coordinates, computation of length of aline, overlaps, flightplanning, computation of required number of photographs for a given area,ground control in photogrammetry, Basic elements inphotographic interpretation. Introduction to digital photogrammetry.

2. Remote sensing-Introduction, Ideal remote sensing system, basic principles ofelectromagnetic remote sensing, electromagnetic energy, electromagneticspectrum, interaction with earth's atmosphere, interaction with earth- surface Remote sensing platforms and sensors: Introduction, platforms- Indian satellite IRS and Land sat specifications, Sensors-active and passive,MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensorresolutions (spatial, spectral, radiometric and temporal).

3. GIS-Definition, Components of GIS, Data types, Sources of data, Data Structure , Types of Analysis and errors, Global positinating system GIS. Applications of Remote sensing: applications in land use land cover analysis, change detection, water resources, urban planning,Design of construction structures, and geological applications.

4. Environmental Applications of RS and GIS Re-modelling of water Distribution systems using GIS Ground water Vulnerability Modelling using GIS Urban Development Planning using RS and GIS Environmental Solid Waste and Degradation Assessment using RS and GIS RS and GIS site selection for Dams, Bridges, Reservoirs.

Books:

1. Mikhail E., J. Bethel, and J.C. McGlone, Introduction to modernphotogrammetry. Wiley, 2001.

2. Wolf P.R, and B.A. Dewitt, Elements of photogrammetry : withapplications in GIS. 3rd ed, McGraw-Hill, 2000.

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)

Town and Country Planning

L	T	P
4	0	0

1. Historic Development & Planning Theory-Origin ,evolution and contemporary developments in planning.,Formation of metropolitan areas &impacts of Industrial Revolution, Socio-economic & technological,impacts of growth of population; rura lurban migration, Characteristics of the urban environment: Land uses, physical structure ,The interim and comprehensive plans: Structure Plan, Master Plan, Zonal Development Plan - their purpose and contents, Surveys, analyses and design methods and practices in comprehensive planning, Residential Areas : Neighborhood and Sector Planning, Planning of New Towns in India and abroad. Spatial & Environmental Aspects of Planning-Environmental degradation and its impact, environmental impact

2. Transportation & Utility Services-Transportation systems; Land use-transportation interrelationships; transportation planning process;Traffic management., Recent innovations in technologies and its probable impacts,Transport policies and evaluation of transportation proposals,Water supply systems,Waste water disposal systems & Solid wastes collection and disposal,Reuse and recycle Techniques,

3. Planning for urban electrical distribution system and communication systems,Economic feasibility tests. Planning Administration & Professional Practices-Planning legislation ,Constitutional basis and provisions relating to land, Evolution of planning laws,Land Acquisition Act of India, MRTP Act 1966,UDPFI Guidelines (implications of 73rd and 74th amendment of the constitution),EPA, Conservation of natural resources, Conservation and Management of Ancient Monuments and Archaeological sites and ruins., Land Development Control,Urban Arts Commission Act, Transportation, Landscape, Housing and slum clearance legislation. ,Role in interdisciplinary groups

4. Social formation & Housing.Housing problems: Urbanization and Industrialization,Slums and squatters settlements - problems and possibilities,Residential layouts, housing densities, neighborhood unit, community facilities,Social aspects : built environment and human behavior, Evaluation of user's satisfaction,Finance for housing: priority in the national plans - role of public and private agencies, role of cooperatives and various institutions,Cost reduction techniques in housing,Housing norms and standards.

Reference Books :

1. K.S.Rangwala and P.S.Rangwala,. "Town Planning ",Charotar Publishing House,15th Edition,1999.
2. Michael Hord, R. Remote sensing methods and application, John Wiley and Sons, New York, 1986.
3. National Building Code of India- Part-III.
4. Municipal and Panchayat bye-laws, CMDA Rules and Corporation bye-laws.
5. KA. Ramegowda, Urban and regional planning , University of Mysor

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)

Advanced Geoinformatics

L	T	P
4	0	0

1. MINERALOGY:Description and identification of Rock forming minerals and Ores, based onphysical and special properties PETROLOGY: Rocks as fundamental units and building materials of the earth crust and theirengineering applications: As building stones, road metals and stones fordecoration, pavement, cladding, roofing, flooring, concreting and foundationengineering. Igneous rocks: Origin, classification (chemical and textural), mode of occurrence Sedimentary rocks: Origin, classification, primary structures Metamorphic rocks: Kinds of metamorphism, and classification.

2. ROCK MECHANICS: Epigene and Hypgene geological agents; rock weathering and its types; Soil formation, types, erosion and remedial measures Geological action of rivers with different drainage patterns; Geological action of wind. Stress, strain and deformational effects on different rocks; Out crop, Dip,strike and escarpment, Clinometer-compass- Joints, faults, folds andunconformities their effects on civil engineering structures.

3. Principles of Remote Sensing: Introduction to remote sensing, Remote sensing system, Electromagnetic spectrum, Black body Atmospheric windows, Spectral characteristics of earth's surface, Range of sensing system. Platforms, Sensors and Data Products: Ground aircraft, space aircraft platforms- photographic sensors, scanners, radiometers, Radar and Mission planning. Data types and format, Scale and Legend Photogrammetry: Photogrammetry basics – applications, applications of aerial photo interpretation to Water Resource Engineering. Photogrammetry and GIS:input of data from photogrammetry for GIS database, photogrammetric applications in GIS

4. Geographic Information System: Introduction, history if GIS, comparisons with CAD, Necessity of GIS, components of GIS, GIS Architecture-data input, data manipulation, data output, Operation-processes and capabilities, different types of GIS, GIS data-spatial and non spatial, data models with advantages and disadvantages. Types of Analysis and errors, Global positinating system GIS.

5. Hyper-spectral Remote Sensing: Hyper-spectral Imaging: Hyper spectral concepts, data collection systems, calibration techniques, data processing techniques; preprocessing, Ndimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Classification techniques, airborne and space-borne hyperspectral sensors, applications. High resolution hyper-spectral satellite systems: Sensors, orbit characteristics, description of satellite systems, data processing aspects, applications.

BOOKS:

1. Text book of Geology by P.K. Mukerjee, World Press Pvt. Ltd.Kolkatta.
2. Structural Geology (3rd Ed.)by M. P. Billings, Published by Prentice Hall of India Pvt. Ltd. New Delhi
3. Text of Engineering and General Geology by ParbinSingh,Published by S. K. Kataria and Sons, New Delhi.
4. Rock Mechanics for Engineers by DrB.P.Verma, Khanna Publishers, New Delhi

Pre Ph.D. Course in Civil Engineering

Schematic and Syllabus

Sr. no.	Nature of Course	Name of course	Credits	Remarks
1.	Core	Research Methodology	4	The syllabus of RM should be formulated faculty wise
		Discipline Specific subjects	4	1.Transportation and Highway Technology 2. Foundation Design and Construction 3.Environment Engineering and Management 4.Pavement Design, Construction and Maintenance 5.Bridge Engineering 6.Advanced Construction Technology 7.Advanced Structural Engineering 8.Hydraulics Engineering 9.Geotechnical Engineering
		Presentation	3	Discipline specific
2.	Interdisciplinary	Elective	4	From list of subjects from allied fields 1.Town and Country Planning 2.Advanced Geoinformatics 3.Computer Aided Design Methods 4. Civil Engineering applications of Remote sensing and GIS
	Total Minimum credits		**15**	

Paper Title: Research Presentation

L T P

0 0 3

Research Scholar will have to present a seminar based upon his/her research area. Performance of the scholar and participation in seminar will be taken into consideration.

Pre Ph.D. Course in Civil Engineering

Research Methodology

L	T	P
4	0	0

1. Introduction Research Methodology: Definition of Research, Need of Research, Concept and steps of Research Methodology , Uses of Research Methodology, Research Techniques. Reviewing Literature: Need, Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review.

2. Identifying and defining research problem: Locating. Analyzing stating and evaluating problem, Generating different types of hypotheses and evaluating them.

3. Data collection: Static and dynamic characteristics of instruments used in experimental set up, calibration of various instruments, sampling methods, methods of data collection, Selection of Appropriate Method for Data Collection, Data collection using a digital computer system, case studies of data collection

4. Data Analysis: Data processing, data analysis strategies and tools, data analysis with statistical packages, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation Applied statistics: Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis Software tools for modeling, Simulation and analysis

5. Research reports and Thesis writing: Introduction: Structure and components of scientific reports, types of report, developing research proposal. Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, word processing tools such as Latex Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

6. Research ethics, IPR and publishing Ethics: ethical issues. IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Books:

1. C.R. Kothari, "Research Methodology – Methods and Techniques", Wiley Eastern Ltd 2009.

2. B.L. Wadehra, Law relating to patents, trademarks, copyright designs and geographical indications, Universal Law Publishing, 2014.

3. K. N. Krishnaswamy, Appa Iyer Sivakumar, M. Mathirajan," Management Research Methodology: Integration of Methods and Techniques, Pearson, 2006 4. S.P Gupta,"Statistical Methods", Sultan Chand & Sons, 2006.

Pre Ph.D. Course in Civil Engineering

Advanced Foundation Design and Construction

L	T	P
4	0	0

1. General Principles of Foundation Design : Functions of foundations, essential requirements of a good foundation, types of foundations, principal modes of failure, estimation of allowable bearing pressures, calculation of ultimate bearing capacity by theoretical and empirical methods: Terzaghi's Method, Skempton's analysis for clays, Mayerhof's analysis BIS Method (IS:6403), Settlement of foundations. Factors to be considered foundation design, numerical problem based in BIS method.

2. Shallow Foundations: Introduction, essential requirements, types and depth of footing like Strip footing, Isolated footing, Combined footing, Strap footing, Raft footing , electrically loaded footings; design features and construction details related to size and depth of footing problem of frost heave, its causes and prevention, effect of ground water and environmental considerations; Numerical problems related to size and depth of footings

2. Pile Foundations : Purpose/uses of pile foundations, Classification of piles based on different criteria, Brief details of timber, concrete, steel piles their advantages and disadvantages , selection of pile type, pile action, behaviour of pile and pile groups under load. definition of failure load. Estimation of carrying capacity : Single driven pile in cohesion less soils - methods based of on SPT and CPT, ultimate load on driven and cast-in-place piles and bored and cast-in-place piles in cohesionless soils. Factors affecting pile capacity.- Numerical problems Ultimate capacity of single pile driven in cohesive soils; modification for driven and cast-in-place piles and bored and cast-in-place piles. Capacity of very long piles – Numerical problems Carrying capacity of piles on rocks.

3. Well foundations: Basic principles, Forces acting on well fundations. Sinking of wells, tilts & shifts

4. Soil Stability: Retaining walls – Introduction, types, Principles of design, Modes of failure, drainage of the back fill, problems related to design of gravity retaining wall and stability of retaining walls.. Unbraced excavations, braced excavations. Sheet piles - types anchors and tie backs. Shoring and Underpinning - necessity and methods

5. Improvement of Foundation Soils Purpose : (a) Improvement of granular soils : term used to describe degree of compactness – relative density, density ratio and degree of compaction; Methods - Vibration at ground surface, factors influencing roller compaction; deep dynamic compaction, vibro-compaction impact at depth. (b) Improvement of cohesive soils : preloading, or dewatering, methods of installing sand drains ,drain wicks, electrical and thermal methods. Grouting : purpose, functions, types of grouts ; soil bentonite - cement mix, cement mix, emulsions, solutions: grout injection methods. Geo-synthetics : types, functions, manufacturing of geo-textiles , Classification of geo-textiles. Specific Applications : Bearing capacity improvement, reinforcement, retaining walls, embankment etc. testing of geo-synthetics, usage in India and a case study.

6. Special Considerations in Foundation Design and Construction: Elementary principles of design and construction of foundations subjected to earthquake or dynamic loads, special measures for foundations constructed under water.

Books :

1. Tomlinson MJ, Foundation Design and Construction , ELBS-Longman, 6e,.

2. Bowles Joseph E, Foundation Analysis and Design, McGraw Hill.

3. Som, NN & Das S.C. , Theory and Practice of Foundation Design, Prentice Hall of India, 2003

4. Braja M. Das, Principles of Foundation Engineering, 6e, Thomson, 2007

5. Koerner, Robert M, Construction and Geotechnical Methods in Foundation Engineering , McGraw Hill,

6. Dinesh Mohan, Pile foundations, Oxford & IBH, 1998

7. Kurian, N.P. Modern Foundations, Tata McGraw Hill, 1982.

8. Fang H.Y. Foundation Engineering Handbook, Van Nostrand Reinhold, 23, 1991.

9. Kaniraj Shenbaga R, Design Aids in Soil Mechanics and Foundtion Engineering, Tata McGraw Hill,

Pre Ph.D. Course in Civil Engineering

Environment Engineering and Management

L	T	P
4	0	0

1. Environment & Ecology: Definition and understanding of concepts, ecosystem, energy flow in ecosystem, water, carbon and nitrogen cycle, community's inter-relationships in an ecosystem. Importance of clean environment.

2. Type of Pollutants and Protection of Environment :Water Pollution : Sources, causes and measurement of water pollutants in surface and ground water, water quality criteria for various uses of fresh water, river basin studies for surface water pollution control, biochemical oxygen demand, effect of oxygen demanding wastes on rivers. Domestic and industrial Pollution : Sources, Standards for disposal of waste water and industrial effluents, basic unit operations in control of waste water pollution, C.P.C.B./M.O.E.F. for abatement of Industrial Pollution and Pollution Control/Treatment methods and technologies.

3. Air Pollution : Definition, principle materials causing pollution, types of air contaminants, their sources and ill effects on living and nonliving materials, permissible limits. air pollution control - basic principles, natural self cleansing, pollution control methods and various engineering devices to control particulate and gaseous pollutants, controlling air pollution from automobiles. Noise Pollution : Definition, sources of noise and its units, adverse effects of noise pollution, sound pressure level and its measurement, octave band and its importance; noise pollution control measures. Solid Waste Pollution: Sources, effects and treatment of solid wastes.

4 Degradation of Land Resources : 3.1 Deforestation and Wetlands : Forest land, deforestation and its effects on land use and environmental quality, wetland and their importance in environment, causes and extent of wasteland, Soil degradation

problems, erosion, salinization, water logging, land use management & planning. *

5 Current Issues in Environmental Engineering : Global warming, ozone depletion, acid rain, oil pollution, radiation hazard and control, role of non- conventional sources of energy in environment.

6 Environment Impact Assessment : Definition and its importance for environment management, constituents of environment impact assessment , project data for EIA study, prediction of impacts, EIA methodologies, constraints in implementation of EIA, impact prediction on water resources projects and other relevant case studies. Environment pollution.

- 7* Land Fills: Sitting criteria. waste containment principles. types of barrier materials Planning and design aspects relating to waste disposal in landfills Control and remediation of subsurface contamination. Case studies

6. Environmental Management System: Main clauses and basic steps for certification. Water pollution, air pollution and EPA and their salient features.

Books:

1. Peavy,Rowe,,Techobanoglous, Environmental Engg. Tata McGrawHill.

2. Mackenzie L Davis, Environmental Engg. Tata McGrawHill.

3. Baljeet S. Kapoor; Environmental Engg. An overview, Khanna Publishers.

4. Glbert H.Masters , Environmental Engineering and Science, Prentice Hall of India Pvt.Ltd.

5. GN Panday, GC Carney Environmental Engineering,Tata McGrawHill.

6. P.D. Sharma, Ecology and Environment Rastogi Publications.

7. Ray P.A Lcances Environmental Impact Assessment Hand Book, National Environmental Protection Council Manila.

8. P Venugopala Rao ; Text Book of Environmental engineering, PHI

Pre Ph.D. Course in Civil Engineering

Pavement Design, Construction and Maintenance

L	T	P
4	0	0

1. Introduction: Types of pavement structure, functions of pavement components. factors affecting pavement design. Design of Pavements: Methods for design of flexible pavements: CBR , Group Index Method , California bearing value method , Triaxial test method , Burmister method , McLeod's method.

2. Design considerations, methods for design of rigid pavements: Westergaard's method, F.A.A. method, types of joints and their design in cement concrete pavments. Thickness . design for Airport pavement ,FAA method for Flexible and Rigid pavements, ESWL Concept , CBR method (USACE) , LCN system of pavement design,

3. Construction of Highways: Types of Highway Construction and their selection, materials for construction, construction procedure of different highways: Gravel roads, WBM , W.M.M., Bituminous pavements, cement concrete pavements, Joints in cement concrete pavements, introduction to various Equipment used for highway construction. Constructional features for Pre-Mix Carpet, Mix Seal Surfacing , B.M. , SDBC. Other higher quality pavement layers – DBM , BC (introduction only)

4. Maintenance of Highways: Pavement failures, their causes and remedial measures typical flexible and rigid pavement failures, types of highway maintenance: routine, periodic and special type, materials used for maintenance of different pavement such as bituminous pavements, cement concrete road, Slurry Seal, Liquid Seal, Fog Seal, Patching Defects/ Failures in Flexible Pavement- their types and causes, Remedial Measures Surface defects, Cracks, Deformation, disintegration, Cracks, Spalling , Slab Rocking , Joint Sealant Failure and Rectification

Books:

1.. Khanna and Justo ; Highway Engineering, Nemchand & Bros. Roorkee

2. Clarkson H.Oglesby and Gary Hicks; Highway Engineering. John Wiley & Sons, London,

3. Rao ; Airport Engineering , Tata McGraw Hill Publishing Co. New Delhi

4. Khanna and Arora.; Airport Planning and Design

5. Wright and Paquette; . Highway Engg , John Wiley and Sons, New York

6. Vaswani, Highway Engg Roorkee Publishing House, Roorkee

7. Sharma and Sharma.; Principles and Practices of Highway Engg., Asia Publishing House, New Delhi .

Pre Ph.D. Course in Civil Engineering

Bridge Engineering

L	T	P
4	0	0

1. Introduction Definition; components of a bridge; classification; importance of bridges. 2. Standard Specifications for Road Bridges: Indian Roads Congress Bridge Code; width of carriageway; clearances; loads to be considered; dead load; I.R.C. standard live load; impact effect; application of live load on decks; wind load; longitudinal forces; centrifugal forces; horizontal forces due to water current; Buoyancy effect ; earth pressure ; temperature effects ; seismic force.

3. Reinforced concrete Bridges : General arrangement and suitability : T-beam bridges; Balanced cantilever bridges ; Continuous girder bridges; Rigid frame bridges; Arch bridges; Steel bridges (Familiarization with MOST specifications and drawings)

4. Sub-Structure : Design of piers and abutments (Masonry & R.C.C).

5. Foundations : Types of foundations; Open; Piled and Well foundations; including construction details. Pile Foundations: Suitable Pile types for bridges, Pile Installation, Carrying capacity of bored and cast- in-situ pile (No numericals) Well Foundations in Components and brief description, Well Cap, Stability of a single well

6. Bearings, Joints, and Handrails : Different types of bearings, joints and handrails.

7. Construction and Maintenance of Bridges, Quality Assurance, Construction Method (brief) Steel bridges, Long span concrete bridge, Traditional method, Incremental Push launching method, Cantilever method, Maintenance, Maintenance of Bearings, Expansion Joints.

Reference Books:

1. Victor Johnson; Essentials of Bridge Engineering , Oxford & IBH Publishing Co, New Delhi.,2007

2. Khadilkar; C.H. , A text book of Bridge Construction, Allied Publisher, New Delhi.

3. Rangwala; Bridge Engg

4. Rowe, R.E., Concrete Bridge Design , John Wiley & Sons, Inc. New York

5. Raina , V.K. , C oncrete Bridges Practice Book , Tata McGraw Hill , New Delhi

6. Jagadeesh, Jayaram : Design of Bridge Structures , Prentice Hall.

7. Raina, V.K. Concrete Bridges Handbook, Galgotia Publications (P) Ltd, New Delhi

Pre Ph.D. Course in Civil Engineering

Hydraulic Engineering

L	T	P
4	0	0

1. Water resources systems analysis, design and management for water supply, irrigation, drainage, hydropower, food control, droughts.Surface and ground water hydrology, stochastic hydrology, physical and numerical modeling, use of finite difference, finite element and boundary element methods.

2. Instrumentation and monitoring of hydraulic systems, computer simulation and optimization of hydrosystems.Computational fluid dynamics, coastal hydrodynamics, watershed management, application of numerical methods.

3. Ground water systems planning and management, ground water pollution investigation. Hydroinformatics, multi criterion decision support system, applications of ANN and GA.

4. Hydraulics of spillways and energy dissipators, pressure fluctuations in hydraulic jump, static and dynamic uplift pressures in stilling basins. Remote sensing and GIS applications, Dam break analysis using softwares.

Books:

1. Principles of water resources planning and management – Goodman

2. Applied hydrology – Linsley Kolhar and Paulhas (McGraw Hill)

3. Computational fluid dynamics – Anderson

4. Neural network fundamentals with graphs, algorithms, applications – Bose N.K. and Liang P (McGraw Hill)

5. Practical handbook of GA applications, Vol I – L. Chambers (CRC Press)

-Pre Ph.D. Course in Civil Engineering

Geotechnical Engineering

L	T	P
4	0	0

1. Advanced Geotechnical Engineering Stress distribution under earth embankments and evaluation of settlement profile. Field problems to monitor movement of slopes, foundations, etc. Advanced Foundation Engineering Foundations in difficult soils: expansive soils, chemically aggressive environment, soft soils, fill, regions of subsidence.

2. Rock mechanics and Tunelling Deformation characteristics of rocks and its measurement. Instrumentation, Underground excavation and subsidence. Bearing capacity of homogeneous as well as discontinuous rocks. Soil Dynamics and Geotechnical Earthquake Engineering Soil behaviour under dynamic loads. Seismic response, strong ground motion, its parameters and their estimation, seismic hazard analysis, local site effects and design ground motion, seismic slope stability

3. Finite Element Methods in Geotechnical Engineering Stress deformation analysis: One-, Two, Three-dimensional formulations; Discretization; Analysis of foundations, dams, underground structures and earth retaining structures. Geo environmental Engineering

4. Landfills, in ash ponds and tailing ponds, and in rocks. Detection, control and remediation of subsurface contamination; Engineering properties and geotechnical reuse of waste.

5. Soil Structure Interaction Elastic and plastic analysis of stress distribution on yielding bases. Analysis of conduits. Interaction analysis of piles and pile groups. Elastic continuum and elastoplastic analysis of piles, Non-linear load-deflection response. Geotechnics for Infrastructure Exploration studies for different Infrastructure Projects, Investigation reports, Analysis and required measures

Books:

1. Aki K and Richards P G (2002), Quantitative Seismology, University Science Books

2. Bowles J E (1996), Foundation Analysis and Design, McGraw Hill.

3. Das B M (1997), Advanced Soil Mechanics, Taylor and Francis.

4. Das B M (1993), Principles of Soil Dynamics, Brooks/Cole

5. Coduto D P (2001), Foundation Design: Principles and Practices, Prentice -Hall

6. Kaniraj S R (1988), Design Aids in Soil Mechanics and Foundation Engineering, Tata McGraw Hill

7. Poulos H G and Davis E H (1980), Pile Foundation Analysis and Design, John Wiley and Sons

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)

Civil Engineering applications of Remote sensing and GIS

L	T	P
4	0	0

1. Photogrammetry and Aerial Photogrammetry Photogrammetry- Introduction, basic definitions, terrestrial photogrammetry, phototheodolite, horizontal and vertical angles from terrestrial photographs, horizontal position of a point from photographic measurements. Aerial Photogrammetry- advantages, vertical, tilted and obliquephotographs, geometry of vertical photographs, scale of vertical photographhover flat and variable terrain, ground coordinates, computation of length of aline, overlaps, flightplanning, computation of required number of photographs for a given area,ground control in photogrammetry, Basic elements inphotographic interpretation. Introduction to digital photogrammetry.

2. Remote sensing-Introduction, Ideal remote sensing system, basic principles ofelectromagnetic remote sensing, electromagnetic energy, electromagneticspectrum, interaction with earth's atmosphere, interaction with earth- surface Remote sensing platforms and sensors: Introduction, platforms- Indian satellite IRS and Land sat specifications, Sensors-active and passive,MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensorresolutions (spatial, spectral, radiometric and temporal).

3. GIS-Definition, Components of GIS, Data types, Sources of data, Data Structure , Types of Analysis and errors, Global positinating system GIS. Applications of Remote sensing: applications in land use land cover analysis, change detection, water resources, urban planning,Design of construction structures, and geological applications.

4. Environmental Applications of RS and GIS Re-modelling of water Distribution systems using GIS Ground water Vulnerability Modelling using GIS Urban Development Planning using RS and GIS Environmental Solid Waste and Degradation Assessment using RS and GIS RS and GIS site selection for Dams, Bridges, Reservoirs.

Books:

1. Mikhail E., J. Bethel, and J.C. McGlone, Introduction to modernphotogrammetry. Wiley, 2001.

2. Wolf P.R, and B.A. Dewitt, Elements of photogrammetry : withapplications in GIS. 3rd ed, McGraw-Hill, 2000.

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)
Computer Aided Design Methods

L	T	P
4	0	0

1. Introduction to CAD and its scope simple description of computer hardware. - Micro, mini etc. - memory, processor - Peripheral devices-disks, printer. Video terminals. Graphic floater, graphic screen digitizer.

2. Computer Graphics: introduction, point plotting techniques, line drawing displays, two-three dimensional transformation, clipping and windowing, segmentation geometric modeling. Three dimensional graphics, curves and surfaces, hidden surface elimination, shading. Graphic input devices. Graphic input technique, input functions. Raster graphic fundamentals, interactive raster graphics, raster graphic systems.

3. Computer aided linkage displays and synthesis, interactive acceleration analysis. Appreciation of graphic packages.

4. Matrix methods of structural analysis and associated computer programme assembly of matrices. Solution of equilibrium equations. Flow charts. Typical listing as illustrations. Introduction to interactive computer programme for the design detailing of simple structural elements: RCC slab, beams, columns, isolated footings etc. Steel typical members and connections.

4. Basics of Design and Analysis Softwares like STAAD PRO, ETABS, ANSYIS, MATLAB.

5. Data base management , storing and retrieving of data

New Topic

Books:

1. Principles of interactive computer graphics by William M. Newman & Robert F.Sproul.

2. Programming in Finite Element by Hunton and owan

3. Principles of Computer Aided design by Joe Rooney & Philips Steadman

4. Computer Fundamentals-P.K.Sinha, BPB Publications

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)

Advanced Geoinformatics

L	T	P
4	0	0

1. MINERALOGY:Description and identification of Rock forming minerals and Ores, based onphysical and special properties PETROLOGY: Rocks as fundamental units and building materials of the earth crust and theirengineering applications: As building stones, road metals and stones fordecoration, pavement, cladding, roofing, flooring, concreting and foundationengineering. Igneous rocks: Origin, classification (chemical and textural), mode of occurrence Sedimentary rocks: Origin, classification, primary structures Metamorphic rocks: Kinds of metamorphism, and classification.

2. ROCK MECHANICS: Epigene and Hypgene geological agents; rock weathering and its types; Soil formation, types, erosion and remedial measures Geological action of rivers with different drainage patterns; Geological action of wind. Stress, strain and deformational effects on different rocks; Out crop, Dip,strike and escarpment, Clinometer-compass- Joints, faults, folds andunconformities their effects on civil engineering structures.

3. Principles of Remote Sensing: Introduction to remote sensing, Remote sensing system, Electromagnetic spectrum, Black body Atmospheric windows, Spectral characteristics of earth's surface, Range of sensing system. Platforms, Sensors and Data Products: Ground aircraft, space aircraft platforms- photographic sensors, scanners, radiometers, Radar and Mission planning. Data types and format, Scale and Legend Photogrammetry: Photogrammetry basics – applications, applications of aerial photo interpretation to Water Resource Engineering. Photogrammetry and GIS:input of data from photogrammetry for GIS database, photogrammetric applications in GIS

4. Geographic Information System: Introduction, history if GIS, comparisons with CAD, Necessity of GIS, components of GIS, GIS Architecture-data input, data manipulation, data output, Operation-processes and capabilities, different types of GIS, GIS data-spatial and non spatial, data models with advantages and disadvantages. Types of Analysis and errors, Global positinating system GIS.

5. Hyper-spectral Remote Sensing: Hyper-spectral Imaging: Hyper spectral concepts, data collection systems, calibration techniques, data processing techniques; preprocessing, Ndimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Classification techniques, airborne and space-borne hyperspectral sensors, applications. High resolution hyper-spectral satellite systems: Sensors, orbit characteristics, description of satellite systems, data processing aspects, applications.

BOOKS:

1. Text book of Geology by P.K. Mukerjee, World Press Pvt. Ltd.Kolkatta.
2. Structural Geology (3rd Ed.)by M. P. Billings, Published by Prentice Hall of India Pvt. Ltd. New Delhi
3. Text of Engineering and General Geology by ParbinSingh,Published by S. K. Kataria and Sons, New Delhi.
4. Rock Mechanics for Engineers by DrB.P.Verma, Khanna Publishers, New Delhi

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)

Town and Country Planning

L	T	P
4	0	0

1. Historic Development & Planning Theory-Origin ,evolution and contemporary developments in planning.,Formation of metropolitan areas &impacts of Industrial Revolution, Socio-economic & technological,impacts of growth of population; rura lurban migration, Characteristics of the urban environment: Land uses, physical structure ,The interim and comprehensive plans: Structure Plan, Master Plan, Zonal Development Plan - their purpose and contents, Surveys, analyses and design methods and practices in comprehensive planning, Residential Areas : Neighborhood and Sector Planning, Planning of New Towns in India and abroad. Spatial & Environmental Aspects of Planning-Environmental degradation and its impact, environmental impact

2. Transportation & Utility Services-Transportation systems; Land use-transportation interrelationships; transportation planning process;Traffic management., Recent innovations in technologies and its probable impacts,Transport policies and evaluation of transportation proposals,Water supply systems,Waste water disposal systems & Solid wastes collection and disposal,Reuse and recycle Techniques,

3. Planning for urban electrical distribution system and communication systems,Economic feasibility tests. Planning Administration & Professional Practices-Planning legislation ,Constitutional basis and provisions relating to land, Evolution of planning laws,Land Acquisition Act of India, MRTP Act 1966,UDPFI Guidelines (implications of 73rd and 74th amendment of the constitution),EPA, Conservation of natural resources, Conservation and Management of Ancient Monuments and Archaeological sites and ruins., Land Development Control,Urban Arts Commission Act, Transportation, Landscape, Housing and slum clearance legislation. ,Role in interdisciplinary groups

4. Social formation & Housing.Housing problems: Urbanization and Industrialization,Slums and squatters settlements - problems and possibilities,Residential layouts, housing densities, neighborhood unit, community facilities,Social aspects : built environment and human behavior, Evaluation of user's satisfaction,Finance for housing: priority in the national plans - role of public and private agencies, role of cooperatives and various institutions,Cost reduction techniques in housing,Housing norms and standards.

Reference Books :

1. K.S.Rangwala and P.S.Rangwala,. "Town Planning ",Charotar Publishing House,15th Edition,1999.
2. Michael Hord, R. Remote sensing methods and application, John Wiley and Sons, New York, 1986.
3. National Building Code of India- Part-III.
4. Municipal and Panchayat bye-laws, CMDA Rules and Corporation bye-laws.
5. KA. Ramegowda, Urban and regional planning , University of Mysor

Pre Ph.D. Course in Civil Engineering

Schematic and Syllabus

Sr. no.	Nature of Course	Name of course	Credits	Remarks
1.	Core	Research Methodology	4	The syllabus of RM should be formulated faculty wise
		Discipline Specific subjects	4	1.Transportation and Highway Technology 2. Foundation Design and Construction 3.Environment Engineering and Management 4.Pavement Design, Construction and Maintenance 5.Bridge Engineering 6.Advanced Construction Technology 7.Advanced Structural Engineering 8.Hydraulics Engineering 9.Geotechnical Engineering
		Presentation	3	Discipline specific
2.	Interdisciplinary	Elective	4	From list of subjects from allied fields 1.Town and Country Planning 2.Advanced Geoinformatics 3.Computer Aided Design Methods 4. Civil Engineering applications of Remote sensing and GIS
	Total Minimum credits		**15**	

Paper Title: Research Presentation

L T P

0 0 3

Research Scholar will have to present a seminar based upon his/her research area. Performance of the scholar and participation in seminar will be taken into consideration.

Pre Ph.D. Course in Civil Engineering

Research Methodology

L	T	P
4	0	0

1. Introduction Research Methodology: Definition of Research, Need of Research, Concept and steps of Research Methodology , Uses of Research Methodology, Research Techniques. Reviewing Literature: Need, Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review.

2. Identifying and defining research problem: Locating. Analyzing stating and evaluating problem, Generating different types of hypotheses and evaluating them.

3. Data collection: Static and dynamic characteristics of instruments used in experimental set up, calibration of various instruments, sampling methods, methods of data collection, Selection of Appropriate Method for Data Collection, Data collection using a digital computer system, case studies of data collection

4. Data Analysis: Data processing, data analysis strategies and tools, data analysis with statistical packages, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation Applied statistics: Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis Software tools for modeling, Simulation and analysis

5. Research reports and Thesis writing: Introduction: Structure and components of scientific reports, types of report, developing research proposal. Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, word processing tools such as Latex Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

6. Research ethics, IPR and publishing Ethics: ethical issues. IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Books:

1. C.R. Kothari, "Research Methodology – Methods and Techniques", Wiley Eastern Ltd 2009.

2. B.L. Wadehra, Law relating to patents, trademarks, copyright designs and geographical indications, Universal Law Publishing, 2014.

3. K. N. Krishnaswamy, Appa Iyer Sivakumar, M. Mathirajan," Management Research Methodology: Integration of Methods and Techniques, Pearson, 2006 4. S.P Gupta,"Statistical Methods", Sultan Chand & Sons, 2006.

Pre Ph.D. Course in Civil Engineering

Transportation and Highway Technology

L	T	P
4	0	0

1. HIGHWAY MATERIALS Soil stabilization types, source, functions, requirements, properties, tests and specifications for use in various components of road, Soil compaction for use in fill and subgrade of roads. Soil stabilization – principle, methods and tests, proportioning of materials and mix design, application of Rotchfutch method. Marginal and waste materials in road construction, properties and scope in road construction. Bituminous Material (properties of the material) and marshall mix design (both wet and dry), Usage of Geosythentics and Geotextiles in construction of highways.

2. HIGHWAY CONSTRUCTION AND MAINTENANCE Components of road and pavement structure functions, requirements and sequence of construction operations. Plants and equipment for production of materials, Road construction equipment, Pre-construction surveys and marking on ground, Different types of granular base course, Different types of sub-base, Road maintenance works and quality control tests as per MORTH specification. SPECIAL PROBLEMS IN ROAD CONSTRUCTION Problems on construction on areas with marshy and weak soils, expansive clays and' water- logged – areas. Design and construction of filter drains and capillary cut-off. Vertical sand drains – application, design and construction method. Road construction on desert region and coastal areas.

3. PAVEMENT DESIGN AND MANAGEMENT Factors affecting design and performance of flexible and rigid pavements – Pavement design factors, loads – axle load distribution. Factors affecting design and performance of airport pavements. Stresses and Deflection / strain in flexible pavements: Application of elastic theory, stresses, deflections / strains in single, two and three layer system. RURAL ROADS Problems associated with planning, design and construction of rural roads low volume rural roads in India. Principle, scope and construction method of various soil stabilization techniques in rural roads. Properties. Design, construction, and maintenance aspects, by resorting to appropriate technology.

4. ROAD SAFETY AND MANAGEMENT Road accidents, causes, scientific investigations and data collection. Road safety issues and various measures for road safety. Engineering, education and enforcement measures for improving road safety. Short term and long term measures. Traffic management techniques. Evaluation of the effectiveness and benefits of different traffic management measures, management and safety practices during road works. Economic evaluation of roads.

5 .TRAFFIC SURVEYS & APPLICATION OF REMOTE SENSING AND GIS IN HIGHWAY ENGINEERING Traffic studies- Trip distribution, generation assignment and model split (Statistical analysis). Design of the traffic signals at urban intersections. Level of service at intersections. Design of parking in urban areas and problems Concepts, components, working of GIS, data capture, data integration, data structures. Coordinate systems and map projections, Registration. GIS analysis and tasks – Input, manipulation, management, query and analysis, visualization, proximity analysis, overlay analysis, GIS and Remote sensing data integration. Overview of image processing softwares and GIS

softwares, Introduction to GPS and its application (includes the recent software's used in the highway engineering)

Books:

1. MoRTH 'Specifications for Roads and Bridges Works'- Indian Roads Congress.

2. IS 73, revised 2006, IS 2720, IS 2386, IS 1201 to 1220, IS 8887- 1995, IS 217- 1986.

3. IRC -37, IRC -58 , IRC: 42-1994, IRC:15-2002, IRC SP :11-1988, , 55-2001, 57-2001,58-2001, IRC 19-1977, 27- 1967, 29-1988, 34-1970, 36- 1970,48-1972,61-1976, 63-1976, 68-1976, 81-1997,82-1982, 84-1983,93-1985, 94- 1986, 95-1987, 98-1997, 105-1988

4. Peurifoy, R.L., and Clifford,JS "Construction Planning Equipment and Method"- McGraw Hill Book Co. Inc.

5. Freddy L Roberts, Prithvi S Kandhal et al, "Hot Mix Asphalt Materials, mixture design and construction"- (2nd Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA

6. Leonards G. A. "Foundation engineering" - McGraw Hill Book Company, New York, 1962

Pre Ph.D. Course in Civil Engineering

Foundation Design and Construction

L	T	P
4	0	0

1. General Principles of Foundation Design : Functions of foundations, essential requirements of a good foundation, types of foundations, principal modes of failure, estimation of allowable bearing pressures, calculation of ultimate bearing capacity by theoretical and empirical methods: Terzaghi's Method, Skempton's analysis for clays, Mayerhof's analysis BIS Method (IS:6403), Settlement of foundations. Factors to be considered foundation design, numerical problem based in BIS method.

2. Shallow Foundations: Introduction, essential requirements, types and depth of footing like Strip footing, Isolated footing, Combined footing, Strap footing, Raft footing , electrically loaded footings; design features and construction details related to size and depth of footing problem of frost heave, its causes and prevention, effect of ground water and environmental considerations; Numerical problems related to size and depth of footings

3. Pile Foundations : Purpose/uses of pile foundations, Classification of piles based on different criteria, Brief details of timber, concrete, steel piles their advantages and disadvantages , selection of pile type, pile action, behaviour of pile and pile groups under load. definition of failure load. Estimation of carrying capacity : Single driven pile in cohesion less soils - methods based of on SPT and CPT, ultimate load on driven and cast-in-place piles and bored and cast-in-place piles in cohesionless soils. Factors affecting pile capacity.- Numerical problems Ultimate capacity of single pile driven in cohesive soils; modification for driven and cast-in-place piles and bored and cast-in-place piles. Capacity of very long piles – Numerical problems Carrying capacity of piles on rocks.

4. Soil Stability: Retaining walls – Introduction, types, Principles of design, Modes of failure, drainage of the back fill, problems related to design of gravity retaining wall and stability of retaining walls.. Unbraced excavations, braced excavations. Sheet piles - types anchors and tie backs. Shoring and Underpinning - necessity and methods

5. Improvement of Foundation Soils Purpose : (a) Improvement of granular soils : term used to describe degree of compactness – relative density, density ratio and degree of compaction; Methods - Vibration at ground surface, factors influencing roller compaction; deep dynamic compaction, vibro-compaction impact at depth. (b) Improvement of cohesive soils : preloading, or dewatering, methods of installing sand drains ,drain wicks, electrical and thermal methods. Grouting : purpose, functions, types of grouts ; soil bentonite - cement mix, cement mix, emulsions, solutions: grout injection methods. Geo-synthetics : types, functions, manufacturing of geo-textiles , Classification of geo-textiles. Specific Applications : Bearing capacity improvement, reinforcement, retaining walls, embankment etc. testing of geo-synthetics, usage in India and a case study.

6. Special Considerations in Foundation Design and Construction: Elementary principles of design and construction of foundations subjected to earthquake or dynamic loads, special measures for foundations constructed under water.

Books :

1. Tomlinson MJ, Foundation Design and Construction , ELBS-Longman, 6e,.

2. Bowles Joseph E, Foundation Analysis and Design, McGraw Hill.

3. Som, NN & Das S.C. , Theory and Practice of Foundation Design, Prentice Hall of India, 2003

4. Braja M. Das, Principles of Foundation Engineering, 6e, Thomson, 2007

5. Koerner, Robert M, Construction and Geotechnical Methods in Foundation Engineering , McGraw Hill,

6. Dinesh Mohan, Pile foundations, Oxford & IBH, 1998

7. Kurian, N.P. Modern Foundations, Tata McGraw Hill, 1982.

8. Fang H.Y. Foundation Engineering Handbook, Van Nostrand Reinhold, 23, 1991.

9. Kaniraj Shenbaga R, Design Aids in Soil Mechanics and Foundtion Engineering, Tata McGraw Hill,

Pre Ph.D. Course in Civil Engineering

Environment Engineering and Management

L	T	P
4	0	0

1. Environment & Ecology: Definition and understanding of concepts, ecosystem, energy flow in ecosystem, water, carbon and nitrogen cycle, community's inter-relationships in an ecosystem. Importance of clean environment.

2. Type of Pollutants and Protection of Environment :Water Pollution : Sources, causes and measurement of water pollutants in surface and ground water, water quality criteria for various uses of fresh water, river basin studies for surface water pollution control, biochemical oxygen demand, effect of oxygen demanding wastes on rivers. Domestic and industrial Pollution : Sources, Standards for disposal of waste water and industrial effluents, basic unit operations in control of waste water pollution, C.P.C.B./M.O.E.F. for abatement of Industrial Pollution and Pollution Control/Treatment methods and technologies.

3. Air Pollution : Definition, principle materials causing pollution, types of air contaminants, their sources and ill effects on living and nonliving materials, permissible limits. air pollution control - basic principles, natural self cleansing, pollution control methods and various engineering devices to control particulate and gaseous pollutants, controlling air pollution from automobiles. Noise Pollution : Definition, sources of noise and its units, adverse effects of noise pollution, sound pressure level and its measurement, octave band and its importance; noise pollution control measures. Solid Waste Pollution: Sources, effects and treatment of solid wastes.

3. Degradation of Land Resources : 3.1 Deforestation and Wetlands : Forest land, deforestation and its effects on land use and environmental quality, wetland and their importance in environment, causes and extent of wasteland, Soil degradation

problems, erosion, salinization, water logging, land use management & planning.

4. Current Issues in Environmental Engineering : Global warming, ozone depletion, acid rain, oil pollution, radiation hazard and control, role of non- conventional sources of energy in environment.

5. Environment Impact Assessment : Definition and its importance for environment management, constituents of environment impact assessment , project data for EIA study, prediction of impacts, EIA methodologies, constraints in implementation of EIA, impact prediction on water resources projects and other relevant case studies. Environment pollution.

6. Environmental Management System: Main clauses and basic steps for certification. Water pollution, air pollution and EPA and their salient features.

Books:

1. Peavy,Rowe,,Techobanoglous, Environmental Engg. Tata McGrawHill.

2. Mackenzie L Davis, Environmental Engg. Tata McGrawHill.

3. Baljeet S. Kapoor; Environmental Engg. An overview, Khanna Publishers.

4. Glbert H.Masters , Environmental Engineering and Science, Prentice Hall of India Pvt.Ltd.

5. GN Panday, GC Carney Environmental Engineering,Tata McGrawHill.

6. P.D. Sharma, Ecology and Environment Rastogi Publications.

7. Ray P.A Lcances Environmental Impact Assessment Hand Book, National Environmental Protection Council Manila.

8. P Venugopala Rao ; Text Book of Environmental engineering, PHI

Pre Ph.D. Course in Civil Engineering

Pavement Design, Construction and Maintenance

L	T	P
4	0	0

1. Introduction: Types of pavement structure, functions of pavement components. factors affecting pavement design. Design of Pavements: Methods for design of flexible pavements: CBR , Group Index Method , California bearing value method , Triaxial test method , Burmister method , McLeod's method.

2. Design considerations, methods for design of rigid pavements: Westergaard's method, F.A.A. method, types of joints and their design in cement concrete pavments. Thickness design for Airport pavement ,FAA method for Flexible and Rigid pavements, ESWL Concept , CBR method (USACE) , LCN system of pavement design,

3. Construction of Highways: Types of Highway Construction and their selection, materials for construction, construction procedure of different highways: Gravel roads, WBM , W.M.M., Bituminous pavements, cement concrete pavements, Joints in cement concrete pavements, introduction to various Equipment used for highway construction. Constructional features for Pre-Mix Carpet, Mix Seal Surfacing , B.M. , SDBC. Other higher quality pavement layers – DBM , BC (introduction only)

4. Maintenance of Highways: Pavement failures, their causes and remedial measures typical flexible and rigid pavement failures, types of highway maintenance: routine, periodic and special type, materials used for maintenance of different pavement such as bituminous pavements, cement concrete road, Slurry Seal, Liquid Seal, Fog Seal, Patching Defects/ Failures in Flexible Pavement- their types and causes, Remedial Measures Surface defects, Cracks, Deformation, disintegration, Cracks, Spalling , Slab Rocking , Joint Sealant Failure and Rectification

Books:

1.. Khanna and Justo ; Highway Engineering, Nemchand & Bros. Roorkee

2. Clarkson H.Oglesby and Gary Hicks; Highway Engineering. John Wiley & Sons, London,

3. Rao ; Airport Engineering , Tata McGraw Hill Publishing Co. New Delhi

4. Khanna and Arora.; Airport Planning and Design

5. Wright and Paquette; . Highway Engg , John Wiley and Sons, New York

6. Vaswani, Highway Engg Roorkee Publishing House, Roorkee

7. Sharma and Sharma.; Principles and Practices of Highway Engg., Asia Publishing House, New Delhi .

Pre Ph.D. Course in Civil Engineering

Bridge Engineering

L	T	P
4	0	0

1. Introduction Definition; components of a bridge; classification; importance of bridges.
2. Standard Specifications for Road Bridges: Indian Roads Congress Bridge Code; width of carriageway; clearances; loads to be considered; dead load; I.R.C. standard live load; impact effect; application of live load on decks; wind load; longitudinal forces; centrifugal forces; horizontal forces due to water current; Buoyancy effect ; earth pressure ; temperature effects ; seismic force.

3. Reinforced concrete Bridges : General arrangement and suitability : T-beam bridges; Balanced cantilever bridges ; Continuous girder bridges; Rigid frame bridges; Arch bridges; Steel bridges (Familiarization with MOST specifications and drawings)

4. Sub-Structure : Design of piers and abutments (Masonry & R.C.C).

5. Foundations : Types of foundations; Open; Piled and Well foundations; including construction details. Pile Foundations: Suitable Pile types for bridges, Pile Installation, Carrying capacity of bored and cast- in-situ pile (No numericals) Well Foundations in Components and brief description, Well Cap, Stability of a single well

6. Bearings, Joints, and Handrails : Different types of bearings, joints and handrails.

7. Construction and Maintenance of Bridges, Quality Assurance, Construction Method (brief) Steel bridges, Long span concrete bridge, Traditional method, Incremental Push launching method, Cantilever method, Maintenance, Maintenance of Bearings, Expansion Joints.

Reference Books:

1. Victor Johnson; Essentials of Bridge Engineering , Oxford & IBH Publishing Co, New Delhi.,2007

2. Khadilkar; C.H. , A text book of Bridge Construction, Allied Publisher, New Delhi.

3. Rangwala; Bridge Engg

4. Rowe, R.E., Concrete Bridge Design , John Wiley & Sons, Inc. New York

5. Raina , V.K. , C oncrete Bridges Practice Book , Tata McGraw Hill , New Delhi

6. Jagadeesh, Jayaram : Design of Bridge Structures , Prentice Hall.

7. Raina, V.K. Concrete Bridges Handbook, Galgotia Publications (P) Ltd, New Delhi

Pre Ph.D. Course in Civil Engineering

Advanced Construction Technology

L	T	P
4	0	0

1. Earthen Dams : Introduction, types ,design considerations/aspects to suit available materials, causes of failures , criteria for safe design ,section, d/s drainage system, seepage analysis, stability analysis, stability of d/s slope during steady seepage, stability of u/s slope during sudden draw down, stability of u/s and d/s slopes during construction, stability of foundation against shear, seepage control measures, design considerations in earthquake regions, design of earthen dam. Quality control in construction of embankments - monitoring of post - construction behaviour and instrumentation.
2. Special Foundations : Foundations for chimney, cooling towers, telecommunication/ ,transmission towers, foundations for underground structures, coastal and off shore structures in different soil conditions, foundations in expansive soils. dewatering and its various methods.
3. High Rise Construction : High rise buildings; architectural & structural aspects; special features of construction; tall chimneys, components, design aspects; slip form method , lift slab method; special problems of high rise construction.
4. Prefabricated Construction : Advantages of pre fabricated construction; selection of structural elements; design aspects; assembly of precast elements; jointing , modular co-ordination and tolerances; structural systems for buildings; single and multi- storey building systems; methods and equipments. For handling and placement
5. Advanced Construction Materials: Geo-synthetics: Various, types; geo-textiles, geo-grids, geo-membranes, geo- composites functions and general applications, advantages , properties of geo-textiles , epoxy resins, polymers, grouts and anchors, special flooring materials ,sealants and adhesives, protective coatings.

Books :

1) Bharat Singh and Varshney RS , Engineering for Embankment Dams - Oxford and IBH.

2) Sharma RK and Sharma TK ; Dam Engineering - Oxford and IBH

3) RS Varshney, SC Gupta and RL Gupta. Theory and Design of Irrigation Structures

4) Naiman P Kurian , Modern Foundations - Introduction to Advanced Techniques Tata McGraw Hill

5) CBRI Roorkee-Application Potential of Geosynthetics in Civil ngineering, Proceedings of workshop January 4-6,1989 Tata McGraw Hill.

6) Bungale S Taranath; Structural Analysis and Design of Tall Buildings , Tata McGraw Hill

Pre Ph.D. Course in Civil Engineering

Advanced Structural Engineering

L	T	P
4	0	0

1. Three dimensional elasticity problems, Torsion of open section, Thermal Stresses, Fracture mechanics. Kirchoff and Mindlin theory of plates, higher order shear deformation theories, classical theories of skew plates, Shell surfaces, bending theory of shells.

2. Mechanics of modern materials, laminated composites, functionally graded materials. Application to plate and shell structures.Structural dynamics, Forced and Damped vibration, modal analysis, response spectra, seismic design of multistoried buildings, codal provisions.

3. Finite Element Method, 2D and 3D applications in plane and three dimensional elasticity problems. Analysis of plate and shell structures. Applications using proper software.Nonlinear analysis of structural elements. Material and geometric nonlinearity. Applications for beam, plates and shells.

4. Multi- variable and Multi-objective optimization. Non linear and non traditional techniques of optimization. Design for reliability, reliability based optimization.Stability Analysis: Beam column, buckling of frames. Lateral buckling of beams, torsional buckling, energy criterion and energy based methods, dynamic stability

Books:

1. Timoshenko and Goodier - Theory of Elasticity, McGraw-Hill Publications

2. S. Crandall, N. Dahl and T. Lardner - Mechanics of Solids, McGraw Hill Publications

3. Anil K Chopra – Dynamics of Structures Theory and Applications to Earthquake Engineering, Prentice-Hall Publications

4. R.W Clough and J Penzin – Dynamics of Structures, McGraw Hill Publications

5. R.C. Roy - Structural Dynamics an Introduction to Computer Methods, John Wiley & Sons Publications

6. S. Timoshenko and W. Krieger, Theory of Plates and Shells, Mc Graw Hill.

7. Ansel C. Ugural, Stresses in Plates and Shells, Mc Graw Hill 8. Chandrashekhara K., Analysis of Plates, New Age International Edition.

Pre Ph.D. Course in Civil Engineering

Hydraulic Engineering

L	T	P
4	0	0

1. Water resources systems analysis, design and management for water supply, irrigation, drainage, hydropower, food control, droughts.Surface and ground water hydrology, stochastic hydrology, physical and numerical modeling, use of finite difference, finite element and boundary element methods.

2. Instrumentation and monitoring of hydraulic systems, computer simulation and optimization of hydrosystems.Computational fluid dynamics, coastal hydrodynamics, watershed management, application of numerical methods.

3. Ground water systems planning and management, ground water pollution investigation. Hydroinformatics, multi criterion decision support system, applications of ANN and GA.

4. Hydraulics of spillways and energy dissipators, pressure fluctuations in hydraulic jump, static and dynamic uplift pressures in stilling basins. Remote sensing and GIS applications, Dam break analysis using softwares.

Books:

1. Principles of water resources planning and management – Goodman

2. Applied hydrology – Linsley Kolhar and Paulhas (McGraw Hill)

3. Computational fluid dynamics – Anderson

4. Neural network fundamentals with graphs, algorithms, applications – Bose N.K. and Liang P (McGraw Hill)

5. Practical handbook of GA applications, Vol I – L. Chambers (CRC Press)

-Pre Ph.D. Course in Civil Engineering

Geotechnical Engineering

L	T	P
4	0	0

1. Advanced Geotechnical Engineering Stress distribution under earth embankments and evaluation of settlement profile. Field problems to monitor movement of slopes, foundations, etc. Advanced Foundation Engineering Foundations in difficult soils: expansive soils, chemically aggressive environment, soft soils, fill, regions of subsidence.

2. Rock mechanics and Tunelling Deformation characteristics of rocks and its measurement. Instrumentation, Underground excavation and subsidence. Bearing capacity of homogeneous as well as discontinuous rocks. Soil Dynamics and Geotechnical Earthquake Engineering Soil behaviour under dynamic loads. Seismic response, strong ground motion, its parameters and their estimation, seismic hazard analysis, local site effects and design ground motion, seismic slope stability

3. Finite Element Methods in Geotechnical Engineering Stress deformation analysis: One-, Two, Three-dimensional formulations; Discretization; Analysis of foundations, dams, underground structures and earth retaining structures. Geo environmental Engineering

4. Landfills, in ash ponds and tailing ponds, and in rocks. Detection, control and remediation of subsurface contamination; Engineering properties and geotechnical reuse of waste.

5. Soil Structure Interaction Elastic and plastic analysis of stress distribution on yielding bases. Analysis of conduits. Interaction analysis of piles and pile groups. Elastic continuum and elastoplastic analysis of piles, Non-linear load-deflection response. Geotechnics for Infrastructure Exploration studies for different Infrastructure Projects, Investigation reports, Analysis and required measures

Books:

1. Aki K and Richards P G (2002), Quantitative Seismology, University Science Books

2. Bowles J E (1996), Foundation Analysis and Design, McGraw Hill.

3. Das B M (1997), Advanced Soil Mechanics, Taylor and Francis.

4. Das B M (1993), Principles of Soil Dynamics, Brooks/Cole

5. Coduto D P (2001), Foundation Design: Principles and Practices, Prentice -Hall

6. Kaniraj S R (1988), Design Aids in Soil Mechanics and Foundation Engineering, Tata McGraw Hill

7. Poulos H G and Davis E H (1980), Pile Foundation Analysis and Design, John Wiley and Sons

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)

Town and Country Planning

L	T	P
4	0	0

1. Historic Development & Planning Theory-Origin ,evolution and contemporary developments in planning.,Formation of metropolitan areas &impacts of Industrial Revolution, Socio-economic & technological,impacts of growth of population; rura lurban migration, Characteristics of the urban environment: Land uses, physical structure ,The interim and comprehensive plans: Structure Plan, Master Plan, Zonal Development Plan - their purpose and contents, Surveys, analyses and design methods and practices in comprehensive planning, Residential Areas : Neighborhood and Sector Planning, Planning of New Towns in India and abroad. Spatial & Environmental Aspects of Planning-Environmental degradation and its impact, environmental impact

2. Transportation & Utility Services-Transportation systems; Land use-transportation interrelationships; transportation planning process;Traffic management., Recent innovations in technologies and its probable impacts,Transport policies and evaluation of transportation proposals,Water supply systems,Waste water disposal systems & Solid wastes collection and disposal,Reuse and recycle Techniques,

3. Planning for urban electrical distribution system and communication systems,Economic feasibility tests. Planning Administration & Professional Practices-Planning legislation ,Constitutional basis and provisions relating to land, Evolution of planning laws,Land Acquisition Act of India, MRTP Act 1966,UDPFI Guidelines (implications of 73rd and 74th amendment of the constitution),EPA, Conservation of natural resources, Conservation and Management of Ancient Monuments and Archaeological sites and ruins., Land Development Control,Urban Arts Commission Act, Transportation, Landscape, Housing and slum clearance legislation. ,Role in interdisciplinary groups

4. Social formation & Housing.Housing problems: Urbanization and Industrialization,Slums and squatters settlements - problems and possibilities,Residential layouts, housing densities, neighborhood unit, community facilities,Social aspects : built environment and human behavior, Evaluation of user's satisfaction,Finance for housing: priority in the national plans - role of public and private agencies, role of cooperatives and various institutions,Cost reduction techniques in housing,Housing norms and standards.

Reference Books :

1. K.S.Rangwala and P.S.Rangwala,. "Town Planning ",Charotar Publishing House,15th Edition,1999.
2. Michael Hord, R. Remote sensing methods and application, John Wiley and Sons, New York, 1986.
3. National Building Code of India- Part-III.
4. Municipal and Panchayat bye-laws, CMDA Rules and Corporation bye-laws.
5. KA. Ramegowda, Urban and regional planning , University of Mysor

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)

Advanced Geoinformatics

L	T	P
4	0	0

1. MINERALOGY:Description and identification of Rock forming minerals and Ores, based onphysical and special properties PETROLOGY: Rocks as fundamental units and building materials of the earth crust and theirengineering applications: As building stones, road metals and stones fordecoration, pavement, cladding, roofing, flooring, concreting and foundationengineering. Igneous rocks: Origin, classification (chemical and textural), mode of occurrence Sedimentary rocks: Origin, classification, primary structures Metamorphic rocks: Kinds of metamorphism, and classification.

2. ROCK MECHANICS: Epigene and Hypgene geological agents; rock weathering and its types; Soil formation, types, erosion and remedial measures Geological action of rivers with different drainage patterns; Geological action of wind. Stress, strain and deformational effects on different rocks; Out crop, Dip,strike and escarpment, Clinometer-compass- Joints, faults, folds andunconformities their effects on civil engineering structures.

3. Principles of Remote Sensing: Introduction to remote sensing, Remote sensing system, Electromagnetic spectrum, Black body Atmospheric windows, Spectral characteristics of earth's surface, Range of sensing system. Platforms, Sensors and Data Products: Ground aircraft, space aircraft platforms- photographic sensors, scanners, radiometers, Radar and Mission planning. Data types and format, Scale and Legend Photogrammetry: Photogrammetry basics – applications, applications of aerial photo interpretation to Water Resource Engineering. Photogrammetry and GIS:input of data from photogrammetry for GIS database, photogrammetric applications in GIS

4. Geographic Information System: Introduction, history if GIS, comparisons with CAD, Necessity of GIS, components of GIS, GIS Architecture-data input, data manipulation, data output, Operation-processes and capabilities, different types of GIS, GIS data-spatial and non spatial, data models with advantages and disadvantages. Types of Analysis and errors, Global positinating system GIS.

5. Hyper-spectral Remote Sensing: Hyper-spectral Imaging: Hyper spectral concepts, data collection systems, calibration techniques, data processing techniques; preprocessing, Ndimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Classification techniques, airborne and space-borne hyperspectral sensors, applications. High resolution hyper-spectral satellite systems: Sensors, orbit characteristics, description of satellite systems, data processing aspects, applications.

BOOKS:

1. Text book of Geology by P.K. Mukerjee, World Press Pvt. Ltd.Kolkatta.
2. Structural Geology (3rd Ed.)by M. P. Billings, Published by Prentice Hall of India Pvt. Ltd. New Delhi
3. Text of Engineering and General Geology by ParbinSingh,Published by S. K. Kataria and Sons, New Delhi.
4. Rock Mechanics for Engineers by DrB.P.Verma, Khanna Publishers, New Delhi

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)
Computer Aided Design Methods

L	T	P
4	0	0

1. Introduction to CAD and its scope simple description of computer hardware. - Micro, mini etc. - memory, processor - Peripheral devices-disks, printer. Video terminals. Graphic floater, graphic screen digitizer.

2. Computer Graphics: introduction, point plotting techniques, line drawing displays, two-three dimensional transformation, clipping and windowing, segmentation geometric modeling. Three dimensional graphics, curves and surfaces, hidden surface elimination, shading. Graphic input devices. Graphic input technique, input functions. Raster graphic fundamentals, interactive raster graphics, raster graphic systems.

3. Computer aided linkage displays and synthesis, interactive acceleration analysis. Appreciation of graphic packages.

4. Matrix methods of structural analysis and associated computer programme assembly of matrices. Solution of equilibrium equations. Flow charts. Typical listing as illustrations. Introduction to interactive computer programme for the design detailing of simple structural elements: RCC slab, beams, columns, isolated footings etc. Steel typical members and connections.

5. Data base management , storing and retrieving of data

Books:

1. Principles of interactive computer graphics by William M. Newman & Robert F.Sproul.

2. Programming in Finite Element by Hunton and owan

3. Principles of Computer Aided design by Joe Rooney & Philips Steadman

4. Computer Fundamentals-P.K.Sinha, BPB Publications

Pre Ph.D. Course in Civil Engineering (Interdisciplinary Course)

Civil Engineering applications of Remote sensing and GIS

L	T	P
4	0	0

1. Photogrammetry and Aerial Photogrammetry Photogrammetry- Introduction, basic definitions, terrestrial photogrammetry, phototheodolite, horizontal and vertical angles from terrestrial photographs, horizontal position of a point from photographic measurements. Aerial Photogrammetry- advantages, vertical, tilted and obliquephotographs, geometry of vertical photographs, scale of vertical photographhover flat and variable terrain, ground coordinates, computation of length of aline, overlaps, flightplanning, computation of required number of photographs for a given area,ground control in photogrammetry, Basic elements inphotographic interpretation. Introduction to digital photogrammetry.

2. Remote sensing-Introduction, Ideal remote sensing system, basic principles ofelectromagnetic remote sensing, electromagnetic energy, electromagneticspectrum, interaction with earth's atmosphere, interaction with earth- surface Remote sensing platforms and sensors: Introduction, platforms- Indian satellite IRS and Land sat specifications, Sensors-active and passive,MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensorresolutions (spatial, spectral, radiometric and temporal).

3. GIS-Definition, Components of GIS, Data types, Sources of data, Data Structure , Types of Analysis and errors, Global positinating system GIS. Applications of Remote sensing: applications in land use land cover analysis, change detection, water resources, urban planning,Design of construction structures, and geological applications.

4. Environmental Applications of RS and GIS Re-modelling of water Distribution systems using GIS Ground water Vulnerability Modelling using GIS Urban Development Planning using RS and GIS Environmental Solid Waste and Degradation Assessment using RS and GIS RS and GIS site selection for Dams, Bridges, Reservoirs.

Books:

1. Mikhail E., J. Bethel, and J.C. McGlone, Introduction to modernphotogrammetry. Wiley, 2001.

2. Wolf P.R, and B.A. Dewitt, Elements of photogrammetry : withapplications in GIS. 3rd ed, McGraw-Hill, 2000.

Pre Ph.D. Course in Civil Engineering

Transportation and Highway Technology

L	T	P
4	0	0

1. HIGHWAY MATERIALS Soil stabilization types, source, functions, requirements, properties, tests and specifications for use in various components of road, Soil compaction for use in fill and subgrade of roads. Soil stabilization – principle, methods and tests, proportioning of materials and mix design, application of Rotchfutch method. Marginal and waste materials in road construction, properties and scope in road construction. Bituminous Material (properties of the material) and marshall mix design (both wet and dry), Usage of Geosythentics and Geotextiles in construction of highways.

2. HIGHWAY CONSTRUCTION AND MAINTENANCE Components of road and pavement structure functions, requirements and sequence of construction operations. Plants and equipment for production of materials, Road construction equipment, Pre-construction surveys and marking on ground, Different types of granular base course, Different types of sub-base, Road maintenance works and quality control tests as per MORTH specification. SPECIAL PROBLEMS IN ROAD CONSTRUCTION Problems on construction on areas with marshy and weak soils, expansive clays and' water- logged – areas. Design and construction of filter drains and capillary cut-off. Vertical sand drains – application, design and construction method. Road construction on desert region and coastal areas.

3. PAVEMENT DESIGN AND MANAGEMENT Factors affecting design and performance of flexible and rigid pavements – Pavement design factors, loads – axle load distribution. Factors affecting design and performance of airport pavements. Stresses and Deflection / strain in flexible pavements: Application of elastic theory, stresses, deflections / strains in single, two and three layer system. RURAL ROADS Problems associated with planning, design and construction of rural roads low volume rural roads in India. Principle, scope and construction method of various soil stabilization techniques in rural roads. Properties. Design, construction, and maintenance aspects, by resorting to appropriate technology.

4. ROAD SAFETY AND MANAGEMENT Road accidents, causes, scientific investigations and data collection. Road safety issues and various measures for road safety. Engineering, education and enforcement measures for improving road safety. Short term and long term measures. Traffic management techniques. Evaluation of the effectiveness and benefits of different traffic management measures, management and safety practices during road works. Economic evaluation of roads.

5 .TRAFFIC SURVEYS & APPLICATION OF REMOTE SENSING AND GIS IN HIGHWAY ENGINEERING Traffic studies- Trip distribution, generation assignment and model split (Statistical analysis). Design of the traffic signals at urban intersections. Level of service at intersections. Design of parking in urban areas and problems Concepts, components, working of GIS, data capture, data integration, data structures. Coordinate systems and map projections, Registration. GIS analysis and tasks – Input, manipulation, management, query and analysis, visualization, proximity analysis, overlay analysis, GIS and Remote sensing data integration. Overview of image processing softwares and GIS

softwares, Introduction to GPS and its application (includes the recent software's used in the highway engineering)

Books:

1. MoRTH 'Specifications for Roads and Bridges Works'- Indian Roads Congress.

2. IS 73, revised 2006, IS 2720, IS 2386, IS 1201 to 1220, IS 8887- 1995, IS 217- 1986.

3. IRC -37, IRC -58 , IRC: 42-1994, IRC:15-2002, IRC SP :11-1988, , 55-2001, 57-2001,58-2001, IRC 19-1977, 27- 1967, 29-1988, 34-1970, 36- 1970,48-1972,61-1976, 63-1976, 68-1976, 81-1997,82-1982, 84-1983,93-1985, 94- 1986, 95-1987, 98-1997, 105-1988

4. Peurifoy, R.L., and Clifford,JS "Construction Planning Equipment and Method"- McGraw Hill Book Co. Inc.

5. Freddy L Roberts, Prithvi S Kandhal et al, "Hot Mix Asphalt Materials, mixture design and construction"- (2nd Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA

6. Leonards G. A. "Foundation engineering" - McGraw Hill Book Company, New York, 1962