Scheme of Examination and Syllabi of course work for
DOCTOR OF PHILOSOPHY
in
Faculty of Engineering & Technology
(2013 – 2014)

PANJAB UNIVERSITY, CHANDIGARH
# Proposed Scheme of Examination and Syllabi of Ph.D. Course
## Work for Academic Session 2013-14

<table>
<thead>
<tr>
<th>S.no</th>
<th>Paper No.</th>
<th>Paper Title</th>
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<th>P</th>
<th>Total</th>
<th>Credits</th>
<th>Marks (Int. Exam)</th>
<th>Marks (Univ. Exam)</th>
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<tbody>
<tr>
<td>1</td>
<td>RM-9001</td>
<td>Research Methodology*</td>
<td>4</td>
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<td>4</td>
<td>50</td>
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<tr>
<td>2</td>
<td>RS-9002</td>
<td>Research Seminar*</td>
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<td>3</td>
<td>Elective **</td>
<td>Group I</td>
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<td>Group III</td>
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<td>Group V</td>
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<td>Group VII</td>
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* Subjects common to all branches.
** A candidate will be assigned any one subject from any of the groups, in the elective, by the Academic Committee.

## List of Electives

### Group I:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Paper No.</th>
<th>Paper Title</th>
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<tbody>
<tr>
<td>1</td>
<td>CSE9101</td>
<td>Network Technologies</td>
</tr>
<tr>
<td>2</td>
<td>CSE9102</td>
<td>Cloud Computing</td>
</tr>
<tr>
<td>3</td>
<td>CSE9103</td>
<td>Advanced Concepts in Digital Image Processing</td>
</tr>
<tr>
<td>4</td>
<td>CSE9104</td>
<td>Advanced Information Security</td>
</tr>
<tr>
<td>5</td>
<td>CSE9105</td>
<td>Modeling and Simulation</td>
</tr>
<tr>
<td>6</td>
<td>CSE9106</td>
<td>Data Warehousing &amp; Data Mining</td>
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<tr>
<td>7</td>
<td>CSE9107</td>
<td>Concepts in Information Retrieval</td>
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### Group II:

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<tr>
<th>S. No.</th>
<th>Paper No.</th>
<th>Paper Title</th>
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<tbody>
<tr>
<td>1</td>
<td>ME9201</td>
<td>Advance Heat Transfer</td>
</tr>
<tr>
<td>2</td>
<td>ME9202</td>
<td>Non Conventional Machining</td>
</tr>
<tr>
<td>3</td>
<td>ME9203</td>
<td>Continuum Mechanics</td>
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<tr>
<td>4</td>
<td>ME9204</td>
<td>Finite Element Methods</td>
</tr>
<tr>
<td>5</td>
<td>ME9205</td>
<td>Composite Materials</td>
</tr>
<tr>
<td>6</td>
<td>ME9206</td>
<td>Optimization Techniques</td>
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<tr>
<td>7</td>
<td>ME9207</td>
<td>Design of Experiments</td>
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### Group III:

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<thead>
<tr>
<th>S. No.</th>
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<th>Paper Title</th>
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<tbody>
<tr>
<td>1</td>
<td>EEE9301</td>
<td>Power System Optimization</td>
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<tr>
<td>2</td>
<td>EEE9302</td>
<td>Power System Reliability</td>
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<tr>
<td>3</td>
<td>EEE9303</td>
<td>Power System Deregulation</td>
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<tr>
<td>4</td>
<td>EEE9304</td>
<td>Power System Stability</td>
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<td>5</td>
<td>EEE9305</td>
<td>Electrical Distribution System</td>
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<td>6</td>
<td>EEE9306</td>
<td>Neural Networks &amp; Fuzzy Logic</td>
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<tr>
<td>7</td>
<td>EEE9307</td>
<td>Industrial Electronics</td>
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<tr>
<td>8</td>
<td>EEE9308</td>
<td>Digital Control</td>
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### Group IV:

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<thead>
<tr>
<th>S. No.</th>
<th>Paper No.</th>
<th>Paper Title</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>ECE9401</td>
<td>Advanced Digital Signal Processing</td>
</tr>
<tr>
<td>2</td>
<td>ECE9402</td>
<td>Digital System Design</td>
</tr>
<tr>
<td>3</td>
<td>ECE9403</td>
<td>Embedded System Design</td>
</tr>
<tr>
<td>4</td>
<td>ECE9404</td>
<td>Wireless &amp; Mobile Communication</td>
</tr>
</tbody>
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### Group V:

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<tr>
<th>S. No.</th>
<th>Paper No.</th>
<th>Paper Title</th>
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<tbody>
<tr>
<td>1.</td>
<td>BT9501</td>
<td>Microbial Biotechnology &amp; Molecular Medicine</td>
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### Group VI:

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<tr>
<th>S. No.</th>
<th>Paper No.</th>
<th>Paper Title</th>
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<tbody>
<tr>
<td>1</td>
<td>CE9601</td>
<td>Foundation Design and Construction</td>
</tr>
<tr>
<td>2</td>
<td>CE9602</td>
<td>Advanced Structural Design and Detailing</td>
</tr>
<tr>
<td>3</td>
<td>CE9603</td>
<td>Environmental Engineering &amp; Mgt.</td>
</tr>
<tr>
<td>4</td>
<td>CE9604</td>
<td>Pavement Design, Construction and Maintenance</td>
</tr>
<tr>
<td>5</td>
<td>CE9605</td>
<td>Bridge Engineering</td>
</tr>
<tr>
<td>6</td>
<td>CE9606</td>
<td>Advanced Construction Technology</td>
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### Group VII:

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<thead>
<tr>
<th>S. No.</th>
<th>Paper No.</th>
<th>Paper Title</th>
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<tbody>
<tr>
<td>1</td>
<td>TE9701</td>
<td>Learning and Instruction</td>
</tr>
<tr>
<td>2</td>
<td>TE9702</td>
<td>ICT Enabled Education</td>
</tr>
<tr>
<td>3</td>
<td>TE9703</td>
<td>Technical and Vocational Education System</td>
</tr>
</tbody>
</table>
* **Guidelines for Course Work:**

The one semester Course Work of minimum 105 teaching hours would comprise three papers out of which one should be relating to Research Methodology (of 35 teaching hours). The components of Continuous Evaluation/ Examination would be as under:

(a) Continuous Evaluation (Book reviews, Term Paper and its presentation, Seminar, etc.) 50 marks

(b) End Examination 50 marks

(c) Pass percentage in each paper (i) & (ii) together : 50%

A candidate who passes will be given ‘S’ grade i.e. Satisfactory completion or else ‘X’ grade i.e. Unsatisfactory.

Further:

(i) A candidate would be required to attend minimum of 75% of the lecturers delivered/activity undertaken;

(ii) If a candidate has passed at least two papers and is unable to pass the 3rd paper due to one reason or the other, he/she be allowed to appear in that paper in the next examination, provided he/she had attended the 75% of the lectures delivered;

(iii) If a candidate is unable to appear in any paper/papers due to the circumstances beyond his/her control. He/she be allowed to appear in that paper/ those papers in the next examination, provided he/she had attended the 75% of the lectures delivered;

(iv) If a candidate fails to earn 10 credits he/she be asked to do the entire course work again;

(v) The End Examination paper will consist of 5 questions and candidate will have to attempt all the questions; and

(vi) A Student Research Committee (SRC) will be constituted for every Ph.D student for continuous monitoring of students’ performance. The proposed constitution of the committee will be as under:
- Chairperson of the department
- Supervisor(s)
- Faculty Member of the allied department

The student will have to present his/her progress report after every 6 months before the SRC.
Objectives: This challenging and comprehensive course provides a broad perspective on Research Methodology.

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.

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

Method of Research: Descriptive research design-survey, case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research.

Sampling Techniques: Concept of population and sample’ sampling techniques-simple random sampling, stratified random sampling, systematic sampling and cluster sampling, quota sampling techniques determining size of sample.

Procedure of data collection: Aspects of data collection, Techniques of data Collection

Statistical Methods of Analysis: Descriptive statistics: Meaning, graphical representations, mean, range and standard deviation, characteristics and uses of normal curve.


Procedure for writing a research proposal and report: Purpose, types and components of research proposal, Audiences and types of research reports, Format of Research report and journal.

Case Studies on s/w tools used for research work.

Books:
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.
Objectives: This challenging and comprehensive course provides a broad perspective on wireless networks.

Overview of wireless networks: Introduction to wireless communication, IEEE 802.11, Wireless ATM, IEEE 802.16 and IEEE 802.20. Review of GSM


WiMAX Networks: Architecture, MAC layer, physical layer, spectrum allocation issues, comparison with WiFi and limitations.

Traffic Management: Economic Framework, Traffic Models, Traffic Classes, Scheduling, Admission Control, Peak Load Pricing


Mobility in networks: Mobile IP and related issues like Route Optimization, Handoff, and Security.

Mobile Ad hoc Networks (MANETs): Introduction to Ad hoc wireless networks and sensor networks, Various MANET issues.

Transport layer: Various transport layer solutions and TCP over Ad hoc wireless networks, TCP extensions for high-speed networks, transaction-oriented applications, other new options in TCP, TCP in Wireless Domain

Network Simulation: Elements of queuing model, role of exponential distribution, Event graphs of queuing model, Discrete-event and Continuous Simulation, Introduction to NS2 and Qualnet.

Books:
7. Requests for Comments (RFCs) & Internet Drafts, published by Internet Engineering Task Force (www.rfc-editor.org)
Objectives: This course offers a good understanding of cloud computing concepts and prepares students to be in a position to design cloud based applications for distributed systems.

Cloud Computing Basics: Cloud Computing Overview; Characteristics; Applications; Internet and Cloud; Benefits; Limitations; Challenges.

Cloud Computing Services and Deployment Models: Infrastructure as a Service; Platform as a Service; Software as a Service; Private Cloud; Public Cloud; Community Cloud; Hybrid Cloud.

Cloud Computing vs Other Computing Technologies: Overview of Grid, Peer-to-Peer, Pervasive and Utility Computing technologies; their characteristics and comparison between them.

Accessing the Cloud: Hardware and Infrastructure requirements; Access Mechanisms: Web Applications, Web APIs, Web Browsers.

Cloud Storage and Cloud Standards: Overview; Storage as a Service; Cloud Storage Issues; Challenges; Standards.


Developing Applications: Major Players in Cloud Business; Overview of Service Oriented Architecture; Tools for developing cloud services and applications. Introduction to Google App Engine, Azure Services Platform, Amazon EC2, Amazon S3.

Migrating to the Cloud: Overview; Issues; Approaches.

Text Books


Reference Books

Objective: To introduce the various image processing techniques and their applications in different domains. To get students acquainted with computer vision.


Image Compression and wavelets: fundamentals, image compression models, elements of information theory, error free compression lossy compression, image compression standards, Color Fundamentals, Wavelets and multiresolution processing: multiresolution expansions, wavelets transforms in one dimension, the fast wavelet transform, wavelets transforms in two dimensions, wavelet packets.

Image Segmentation, Recognition and Analysis: Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region- Based Segmentation, Representation and Description: Boundary descriptors, Regional Descriptors, Use of Principal Components for Description, Relational Descriptors, Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

Case studies on research areas related to image processing.

Text Books:

Reference Books:


Text Book

References:
Objectives: This course should provide the students with good understanding of various techniques of Simulation. At the end of this course students will be having good knowledge of simulation concepts and simulation languages.

Introduction: What is modeling and simulation? Application areas, definition and types of system, model and simulation, introduction to discrete-event and continuous simulation.

Simulation Methods: Discrete-event Simulation, Time advance Mechanisms, Components and organization of Discrete-event simulation, Flowchart of next-event time advance approach, Continuous Simulation, Random Number generation methods.

Queuing Models: Single server queuing system, introduction to arrival and departure time, flowcharts for arrival and departure routine. Event graphs of queuing model. Determining the events and variables.

Distribution Functions: Stochastic activities, Discrete probability functions, Cumulative distribution function, Continuous probability functions. Generation of random numbers following binomial distribution, poisson distribution, continuous distribution, normal distribution, exponential distribution, uniform distribution.

Programming in MATLAB: Introduction, Branching statements, loops, functions, additional data types, plots, arrays, inputs/outputs etc.

Programming in GPSS and C/C++: Basic Introduction to Special Simulation Languages: GPSS and Implementation of Queuing Models using C/C++.

Introduction to Simulators: Introduction regarding features and usage of any Network simulator.

Books:
Objectives: This course should provide the students with good understanding of various techniques of Data Warehousing & Data Mining. At the end of this course students will be having good knowledge of Data Mining concepts and warehousing techniques.

Introduction: Introduction to RDBMS, Data Warehouse, Transactional Databases, Data Mining Functionalities, Interestingness of pattern, classification of data mining system, major issues

Data Warehouse and OLAP: Difference from traditional databases, Multidimensional data model, Schema for Multi dimensional model, measures, concept hierarchies, OLAP operations, starnet query model, Data Warehouse architecture, ROLAP, MOLAP, HOLAP, Data Warehouse Implementation, Data Cube, Metadata Repositories, OLAM

Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept hierarchy generation

Data Mining Architecture: Data Mining primitives, Task relevant data, interestingness measures, presentation and visualization of patterns, Data Mining Architecture, Concept Description, Data Generalization and Summarization, Attributed oriented induction, Analytical characterization, Mining class comparisons,

Association Rules: Association rules mining, Mining Association rules from single level, multilevel transaction databases, multi dimensional relational databases and data warehouses, Correlational analysis, Constraint based association mining

Classification and Clustering: Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbor classification, Cluster analysis, Types of data in clustering, categorization of clustering methods

Introduction of Mining Complex Data: Complex data objects, Mining spatial databases, Multimedia databases, Time Series and sequence databases, Text databases and World Wide Web

Books:

2. Data Mining Introductory and Advance Topics By Dunham, Pearson Education, Latest Edition
Introduction
Introduction to Information Retrieval, Inverted indices and Boolean queries.

Term vocabulary and postings lists
Tokenization, stemming, lemmatization, stop words. Usage of Skip pointers, positional posting and phrase queries.

Dictionaries and tolerant retrieval
Dictionary data structures, Wild-card queries, Spelling and phonetic correction.

Index construction and compression
Blocked sort-based indexing, single pass in-memory indexing, distributed and dynamic indexing.

Scoring
Parametric and zone indexes, term frequency and weighting, vector space model for scoring, various tf-idf functions, Components of an IR system, Computing scores in a complete search system

Classification

Web Search and Crawling
Web search basics, crawling architecture, distributed indexes, link analysis.

Evaluation of information retrieval systems:
Evaluation of unranked and ranked retrieval sets, assessing relevance, probabilistic information retrieval, language models for information retrieval.

Text Books:
**Conduction:** Steady state heat conduction including heat generation and heat losses in different co-ordinates, numerical analogue and graphical methods. Unsteady state heat conduction as applied to thick wall, cylinder and sphere with sudden and with periodic changes of surface temperature. Semi-infinite state with imposed wall temperature distribution. Heat conduction with moving boundaries numerical analogue and graphical methods.

**Conductive Heat Transfer:** Fundamentals: Reynold transport theorem. Derivation of N.S equation and energy; Dimensionless Number.

**Convection:** Laminar duct flows: Convection in fully developed flow and developing flow. Effect of wall boundary condition. Natural Convection: External flows; boundary laying integral similarity solution; Exact & empirical correlation, Heat transfer over plane plate, cylinders, tube banks and spheres. Turbulent Flows: Fundamental of Turbulent Heat convection; turbulent boundary layer; Exact & empirical correlations.


**Books:**
1. Incropera & Dewtt,” Heat & Mass Transfer”, John Willey Ltd.
2. J.P. Holman,” Heat Transfer”,TMH
Introduction: Classification, Advantages & limitations of non conventional machining, Hybrid Machining, Ultrasonic machining (USM)-Principle of operation, process details, applications and advantages, limitations of USM.

Abrasive and Water Jet Machining: Basic principle, mechanism of material removal, working principle of Abrasive jet machining (AJM), water jet machining (WJM), merits & demerits, application.

Chemical Machining (CM): Working principle, process characteristics, procedures, advantages & disadvantages of chemical machining.

Electrochemical Processes: Fundamentals, details of machining setup, materials and selection of tools, applications, Concept of others processes like ECG, Electrochemical deburring etc.

Thermal Metal Removal Processes: Working principles, Mechanism of material removal, process parameters, advantages & limitations, applications of processes like electric discharge machining(EDM), Electron Beam Machining (EBM), Ion beam machining (IBM), Plasma arc machining (PAM), Laser beam machining(LBM).

Books:
1. V K Jain,”Advanced Machining Processes,” Allied
2. Benedict,” Unconventional Machining Methods”, McH
3. HMT ,”Production Technology,” TMH
4. M. Adithan,”Non Conve移送al Machining,” John Wiley
5. P.K. Mishra,” Non Conventional Machining”, Narosa
6. Shan & Pandey,” Modern machining process”,TMH
1. Introduction
2. Tensors: Indicial Notation, Tensors, Tensor Calculus, Curvilinear Coordinates
3. Kinematics of a Continuum
4. Stress
5. Integral Formulation of General Principles
6. The Elastic Solid: Linear Isotropic Solid, Linear Anisotropic Elastic Solid, Constitutive Equation for Isotropic Solid under Large Deformation
7. Newtonian Viscous Fluid

1-D FE Modeling: Finite Element Modeling, Coordinates and Shape Functions, Generalized Coordinates, Natural Coordinates in 1D, 2D and 3D, Coordinate Transformation, Assembly of Global Stiffness matrix and Load vector, Properties of Stiffness Matrix, Treatment of Boundary Conditions and Temperature Effects. Truss and Beam Elements

2-D FE Modeling: Finite Element Modeling, Constant Strain Triangle (CST)

3-D FE Modeling: The Four Node Quadrilateral, Numerical Integration, Higher Order Elements; Nine Node Quadrilateral, Eight Node Quadrilaterals, Six Node Triangle

Truss: Introduction, Plane Trusses, Assembly of Global Stiffness Matrix and load vector

Higher-Order Elements: Plate Bending, C0 and C1 Elements, Non-conforming Elements and Patch Test


Dynamic Considerations: Element Mass Matrices, Evaluation of Eigen Values and Eigen Vectors. (Introduction only)

Computer Implementation: Introduction; Computer Program Organization for Calculation of System Matrices

Books:
1. Chandrupatla and Belegundu, “Introduction to Finite Elements in Engineering”, PHI
2. Bathe, “Finite Element Procedures”, PHI
Introduction: General introduction to composites; historical background; concept of matrix and reinforcement and particulates.

Matrix and reinforcement: Types of matrix and reinforcement, volume fraction and weight fraction. Fiber architecture fiber packing arrangements, whiskers.

Fabrication methods of polymer composites: Liquid resin impregnated routes, pressurized consolidation of resin pre-peggs, consolidation of resin molding compounds, injection molding of thermoplastics, hot press molding of thermoplastics.

Fabrication of ceramic composites: Powder based routes, reactive processing, layered ceramic composites, carbon/carbon composites.

Fabrication routes of metal matrix composites: Squeeze infiltration, stir casting, spray deposition, powder blending and consolidation, diffusion bonding of foils, PVD.

Testing and characterization: Different tests like internal stress measurement by diffraction, metallographic preparation etc with special emphasis to metal matrix composites.

Secondary processing and application of composites: Secondary processing like machining, joining, extrusion of composites; Application and case studies.

Books:
3. Introduction to metal Matrix Composite
Objectives: This course will provide the students with good understanding of various optimization techniques used in engineering applications. At the end of this course, students will be having good knowledge of optimization techniques, their concept and applications.

Numerical Techniques: Introduction to numerical techniques, Numerical differentiation and numerical integration, Eigen value problems, Newton-Raphson’s method, Computer based numerical analysis.

Introduction to Optimization: Introduction and Engineering applications of optimization, Optimal Problem Formulation; Design –variables, Constraints, Objective function, Variable bounds.


Integer Programming
Geometric Programming

BOOKS:

Introduction: Strategy of experimentation, Some typical applications of experimental design, Basic principles, Guidelines for designing experiments, A brief history of statistical design, Using statistical design in experimentation

Simple Comparative Experiments: Introduction, Basic statistical concepts, Sampling and sampling Distribution, Inferences about the Differences in means, randomized designs, Paired comparison Designs, Inferences about the Variances of Normal Distributions

Introduction To Factorial Design: Basic definition and principles, Advantages of factorials, The two factor factorial design, General factorial design, Fitting response curves and Surfaces, Blocking in a factorial design

Fitting Regression Models: Introduction, Linear regression models, Estimate of parameters in linear regression models, Hypothesis testing in multiple regression, Confidence intervals in multiple regression, Prediction of new response observations, Regression model diagnostics, Testing for lack of fit

Taguchi Method Of Design Of Experiments: Concept design, Parameter design, Tolerance design, Quality loss function, Signal-to- Noise ratio, Orthogonal array experiments, Analysis of Mean (ANOM), Quality characteristics, Selection and testing of noise factors, Selection of control factors, Parameter optimization experiment, Parameter design case study

Analysis of Variance (Anova): Introduction, Example of ANOVA process, Degrees of freedom, Error variance and pooling, Error variance and application, Error variance and utilizing empty columns, the F-test

Recommended Books:

GROUP - III

Paper Title: Power System Optimization
Paper Code: EEE9301

Introduction to Optimization and Classical Optimization Techniques: single variable optimization, multivariable optimization without constraints, multivariable optimization with equality constraints, multivariable optimization with inequality constraints.


Dynamic Programming: multistage decision process, concept of suboptimization and principle of optimality, conversion of final value problem into an initial value problem, LP as a case of dynamic programming.

Genetic Algorithm: introduction to genetic algorithm, working principle, coding of variables, fitness function, GA operators, similarities and differences between GA and traditional methods, unconstrained and constrained optimization using GA.

Applications to Power System: economic load dispatch in thermal and hydro thermal system using GA, unit commitment problem, reactive power optimization, LPP and NLP techniques to optimal flow problems.

Books:

3. Kothari and Dhillon, “Power System Optimization”, PHI.
Probability and Reliability: Review of probability concepts, probability distributions, applications of binomial distribution to engineering problems, probability distribution in reliability evaluation, reliability indices, network modeling and evaluation of simple and complex networks, system reliability evaluation using probability distributions, frequency and load duration techniques, key indices of power system reliability and their calculations.

Generation System Reliability Evaluation: Concept of loss of load probability (LOLP), Energy demand, E (DNS), Evaluation of these indices for isolated systems, generation system, reliability analysis using the frequency and duration techniques.

Transmission System Reliability Evaluation: Evaluation of LOLP and E (DNS), indices for an isolated transmission system, interconnected system reliability, bulk power system reliability.

Distribution System Reliability Evaluation: Reliability analysis of radial systems with perfect and imperfect switching.

Books
1. Billinton R., “Power System Reliability Calculation”
2. Endreyni, “Power System Reliability Evaluation”
**Power Sector Economics:** Introduction to various concepts such as depreciation, fixed & variable cost, profitability indices, net present value, financing of power sector. Different techniques for project evaluation (capital cost, life cycle cost), various aspects of capital costs, comparison annualize cost. Typical Cost Components of utilities & their determinants (power purchase cost, C&M cost, manpower, depreciation, finance charges, full cost). Tariff setting principles Rate structure, Average cost of supply, cost to serve various consumer categories, marginal cost.

**Performance of Indices of Power Utility:** Performance indices for different aspects power utility such as generation, transmission, distribution, metering, billing, costs, power quality & consumer service.


**Power Sector in India:** Evaluation of integrated, monopoly, state owned electricity boards. Introduction to various institutions in Indian power sector & their role. Challenges before the Indian power sector, planning commission CEA, NT, PFC, ministry of power SEBS.

**Power Sector Restructuring:** Structural models (single buyer model wholesale competition Retail competition) Ownership model (Public sector state owned and municipal utilities, joint sector, cooperatives and private sector).

**Review of International experience of Restructuring:** - Rational for restructuring structural and ownership changes, outcomes technological aspects of restructuring, Impact of Power Sector restructuring on DSM, IRP, and Regulation.

**Overview of legal framework governing Indian Power Sector.**

**Books:**
1. Kahn Edward, “Electric Utility Planning and Regulation” –, University of California
3. Tripathi S.C, “Electrical Energy Utilization And Conservation” (TMH Pub.)


Books


Distribution System Expansion Planning – load characteristics, load forecasting, design concepts, optimal location of sub station, design of radial lines, solution technique.

Voltage Control – Application of shunt capacitance for loss reduction, harmonics in the system, static VAR systems, loss reduction and voltage improvement.

System Protection Requirement – fuses and section analyzers, over current, under voltage and under frequency protection, coordination of protective device.

Books
Fundamentals of Neural Networks:

Supervised Learning:


Fuzzy Logic: Basic concepts of Fuzzy Logic, Fuzzy vs. Crisp set Linguistic variables, membership functions, operations of fuzzy sets, Crisp relations, Fuzzy relations, Approximate reasoning, fuzzy IF-THEN rules, variable inference, techniques, defuzzification techniques, Fuzzy rule based systems. Applications of fuzzy logic.

Recommended Books:
1. Satish Kumar,”Neural Network : A classroom approach”.
2. Jacek M.Zurada,” Artificial Neural Networks”.
3. Simon Haykin,” Artifical Neural Network”.
4. Rajasekaran & Pai,”Neural networks, Fuzzy logic and genetic algorithms”.
5. Hagan, Demuth & Beale,”Neural Network Design.”.
6. T. J. Ross,” Fuzzy logic with engineering applications”.
**Power Semiconductor diodes and transistors:** Characteristics of power diodes, power transistor, power MOSFETS, insulated Gate Bipolar Transistor (IGBT), Mos-controlled thyristor and their comparison.

**Thyristors and their characteristics:** Review of thyristors such as SCR, TRIAC, GTO, PUT, SUS, SCS, ASCR, RCT. Thyristor Controlled Circuits.

**Three phase controlled rectifiers:** Single phase half wave and full wave converters. Analysis of three phase rectifier, Effect of source impedance on the performance of converters, Dual Converters.

**Choppers:** Control strategies, step up choppers, A, B, C, D and E type of choppers, Voltage, Current and Load commutated choppers.

**Inverters:** Single phase series and parallel inverter, single-phase & three-phase bridge inverters, Pulse width modulated inverters, Reduction of harmonics in the inverter output voltages, Current source inverter.

**Cycloconverters:** Single phase, Mid-point and bridge type cycloconverters. Three phase half-wave cycloconverters, Output voltage equation, Load commutated cycloconverters.

**Electric drives:** Single-phase and three-phase dc drives, chopper drives, ac drives, Induction motor drives, Speed control of three-phase induction motors, Synchronous motor drives, Microprocessor controlled ac and dc drives.

**FACTS Controllers:** SVC, TCSC, STATCOM, SSSC, UPFC

**Books Recommended:**

Introduction: Control system terminology, control theory history and trends, computer-based control. An overview of classical approach to analog controller design. Basic digital control scheme.


Models of Digital Control Devices and Systems: Z-domain description of sampled continuous-time plants and systems with dead-time, Digital Controller design using direct synthesis procedures.

Control System Analysis using State Variable Methods for Digital Control Systems: State variable representation, Conversion of state variable models to transfer function and of transfer function to canonical state variable models, Eigen values and Eigen vectors, Solution of state difference equations, controllability and Observability, Multivariable system.


Lyapunov stability analysis
Basic concepts, Stability definitions and theorems, Lyapunov functions for linear and non linear systems, A model reference adaptive system.

Linear Quadratic Optimal Control
Parameter optimization and optimal control, Quadratic performance index, control configurations, State regulator design through the Lyapunov equation, Optimal state regulator through the Matrix Riccati-equation for digital control systems.

Books Recommended:

GROUP - IV

Paper Title: Advanced Digital Signal Processing
Paper Code: ECE9401

Transformations:

Digital Filters:

Multirate Digital Signal Processing:
Sampling Rate Alteration Devices, Multirate Structures for sampling rate conversion, Multistage design of Decimator and Interpolator, The Polyphase Decomposition, Arbitrary Rate Sampling Rate Converter, Filter Banks, QMF banks, Multilevel Filter Banks, Sub-band Coding, Discrete Wavelet Transform.

Linear Prediction and Optimum Linear Filters:
Forward and Backward Linear Prediction, Properties of Linear Prediction-Error Filters, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Adaptive Digital Filters:

Power Spectrum Estimation:

DSP Chips:
Introduction to fixed point and floating point processors, ADSP21xx and TMS320Cxx-Architecture, Memory, Addressing Modes, Interrupts, Applications. Comparison of ADSP21xx and TMS320Cxx series.

Books:
7. “Modern Filter Theory”, by Johnson & Johnson
**Introduction to Digital Design Concepts:**
Design Constraints and Logic Representation of System.

**Analog interfacing:**
A/D conversion concepts, Analog & Digital Conversion related errors.

**Combinational Logic Design and Implementation:**
Multiplexer/Decoder, PLA/PAL/GAL-ROM,CPLD and FPGA level customized design, ALU, VHDL models and simulations of combinational circuits.

**Sequential Logic Design and Implementation:**
Practical Synchronous and asynchronous circuit design. Design and Implementation of sequential digital system, state representation, analysis of digital systems, synchronization, design criteria, design procedure. High level modeling of digital systems, controller realization, Timing & Frequency consideration, system examples. VHDL models and simulation of sequential circuits

**Design for Testability:**
Fault and Fault coverage in digital circuits, internal scan test methodology, BIST and Boundary scan (JTAG) techniques.

**Books:**
1. Combinational design & testing using PLA/PAL/ROM chips.
2. Combinational design, simulation, synthesis & implementation.
3. W.J.Fletcher,” An Engineering Approach to Digital Design”,
5. J.F.Wakerly,” Digital Design principles and practices”,
6. Ronald Tocci,”Digital Systems-Principles and applications”,
**Introduction to Embedded System:**
Their classification & characteristics, Concepts and Processes of system level design of embedded system.

**Microcontrollers:**
Introduction to microcontrollers, Memory, Buses, Direct Memory Access, Interrupts, Microprocessor Architecture, Interrupt Basic, Shared Data Problems, Interrupt Latency, PIC 16F8XX Flash Microcontrollers, CPU architecture, Register file structure, Instruction Set, Programs, Timers and Interrupts, Interrupt Service Routine, Features of Interrupts, Interrupt vector & Priority, Timing Generation & Measurements, Interfacing Methods, I/O Interface, LCD interfacing, Seven segment interfacing, I²C Bus, DAC, ADC, UART.

**Program Modeling Concepts in Single and multiprocessor system Software- Development Process:**
Modeling Processes for software Analysis before software implementation, Program model for event controlled, Modeling of Multiprocessor Systems.

**Embedded Core Based Design:**
System-on-Chip, Application specific Integrated circuit, Overview of Embedded Processors like ARM, MIPS and Intel MMX series, Architecture, Organization and instruction set, Memory management, High level logic synthesis. Data parallel issues e.g SIMD, MIMD, MISD, SISD. Introduction to FPGA, Basics of FPGA.

**Real Time programming and Operating System (RTOS)**
RTOS Overview, Basics of RT- Linux as a RTOS, Assembly language, C++

**Books:**
1. Ajay V. Deshmukh,” Microcontrollers (Theory and Applications)”
2. David E. Simon,” An Embedded System Primer”
3. Steve Heath,” Embedded system Design”
5. Steve Furber,”ARM system architecture “,Addison Wesley
7. H. Kopetz,” Real Time Systems”
8. Raj Kamal,” Embedded Systems”
Mobile Communication:
Types of Mobile Communication Systems, Mobile radio systems around the world, Trends in cellular radio and personal communications.

Cellular Design Fundamentals:
Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, mechanism for capacity improvement-cell splitting, cell sectoring, and micro cell zone concept.

Multiple access schemes: TDMA, FDMA, CDMA, WCDMA, OFDMA, Random Multiple access Scheme, Packet Radio Protocols, CSMA, Reservation Protocols, Capacity of Cellular systems.


Introduction to 3G Wireless Networks:
WiFi, WiMax, Bluetooth

Books:
1. Raj Pandya,”Mobile and personal Communication Systems and services”, PHI
2. Rappart,”Wireless Communication,” PHI
3. Lee,”Mobile Communication”,TMH
4. Dharam Prakash Aggarwal, Qing-Anzeng,”Wireless & Mobile System”, Thomson
Course Title: Microbial Biotechnology & Molecular Medicine
Course Code: BT9501

**Microbial Metabolism & Strain Improvement:** Microbial metabolic pathways-amphibolic and biosynthetic, production of primary and secondary metabolites, microbial products of industrial importance, ideal growth medium for production of biomass and a microbial product, culture preservation, strain improvement by mutagenesis and by genetic means.

**Techniques in Biotechnology:** (For Purification and characterization of industrial products)
2. Chromatography: Principle, Types of Chromatography such as gel permeation, ion exchange, affinity etc, modes of Chromatography, Applications.
3. Electrophoresis: Principle, protein and DNA electrophoresis, SDS-PAGE, preparative and analytical, applications of each type.
4. Spectrophotometry.

**Microbial Pathogenesis and Drug Development:** Understanding pathogenesis, multidrug resistance and mechanisms, screening of microbes and microbial compounds for development of new chemotherapeutic agents, Disease diagnosis, identification and characterization of novel proteins by proteomics study, 2D PAGE and Mass spectrometry.

**Books:**
2. Toratora, ”Microbiology: An Introduction”, Benjamin Publication Co.
Foundations form integral part of all civil engineering structures viz buildings, bridges, chimneys etc. Understanding behaviour of soil-foundation interaction is essential for safe distribution of structural load and stability. The subject is intended to impart the following knowledge and skills:

(i) Estimate bearing capacity for different types of shallow foundations under different soil conditions and placement of footing.
(ii) Know construction aspects of various types of shallow foundations and their suitability under various conditions.
(iii) Know various types of pile foundations and estimate the carrying capacity of pile(s) or design pile/pile group.
(iv) Explain various methods of improvement of soils and select a suitable method for given conditions.
(v) Describe various methods of rectification of foundations.

CONTENTS

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.
   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.
Piles in fills - negative skin friction
Carrying capacity of pile groups in cohesive soil and cohesionless soils,
Efficiency of pile group.
Piles subjected to horizontal or inclined loads.
Mode of failure of piles
Equipment for Installation of Piles by Driving and Boring and cast in place method

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.
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.

**Practical Exercises:**
2. Determination of shear strength characteristics by field tests like in situ vane shear test, pocket penetrometer etc.
3. Determination of shear strength characteristics by laboratory tests.
4. Computation of bearing capacity and settlement for given conditions of soil, depth and type of foundation and loading.
5. Recommend a field investigation programme to obtain design data.
6. Design of a shallow foundation. (Determination of depth and size of footing)
7. Recommend suitable dimensions, depth and spacing of pile/pile group for given loading conditions.
Reference Books:

5. Koerner, Robert M, Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill,
10. Fleming et al, Piling Engineering, Surrey Univ. Press/John Wiley and Sons.,
13. Peck, Hanson, Thornburn, Foundation Engineering, Wiley Eastern Ltd. 2e, 1980
18. Duggal A K, Pile Foundations, NITTTR, Chandigarh, 2005
19. IS: 6403 Determination of bearing capacity of Shallow foundations
20. IS 8007- Part –I Calculation of Settlement of Foundation
Objectives:
All civil engineers must be familiar with structural design and detailing for effective implementation of projects involving construction of different types of structures. The subject of structural design and detailing is included in the Construction Technology and Management course to give an insight to the student about analysis and design of complex structures in concrete and steel. While the different types of structures being constructed are many, it is hoped that this introduction to common types of structures will enable them to get a good understanding of structural design and detailing.

CONTENTS

1. Introduction:
   Introduction to limit state method of design; provisions in the Indian Standard codes for loading, wind loads and seismic loads, design and detailing of concrete structures. [4]

2. BIS handbook for design:
   Examples of design using handbook [4]

3. Structural Analysis and Design for:
   * Columns with biaxial moments. [4]
   * Curved beams [4]
   * Intze tank and underground water tanks [10]
   * Silos and bunkers [8]
   * Concrete Chimneys [6]
   * Multi-storey building frame design [8]
   * Use of computer software for analysis and design [6]

Practice tasks:
   i) Analysis and design of beams using the BIS handbook for design
   ii) Complete analysis and design of an underground water tank
   iii) Analysis and design of a silo
   iv) Analysis and design of a concrete chimney using design tables.
   v) Analysis and design of a 10-storey building using a computer programme.

Reference Books:
1. Dayaratnam, P: Reinforced Concrete Structures.
4. Jain and Jaikrishna: Plain and Reinforced Concrete Vol II.
5. STAAD Pro- (Software)
Objectives:
Environment and development are two sides of the same coin. Environmental degradation
due to social-economic developmental activities and fast growing industry has created the
need of environmental awareness among planners, builders and managers of various
engineering project. The significance of threat to our ‘Environment’ and the urgent need to
respond appropriately to the same is widely recognized. The environmental pollution is
threatening the health and quality of life of people. The quality of built environment and
 provision of infrastructure services are adversely affected by the pace of development and
 inadequate human response. It is necessary that the engineers should be aware of harmful
effects of pollution and should be able to take preventive steps for controlling the
pollution. This subject will help the students to acquire knowledge with reference to
various sources of pollution and planning of remedial measures to control pollution.

CONTENTS

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)

2. Type of Pollutants and Protection of Environment
   2.1 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.
   2.2 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.
   2.3 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.
   2.4 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.
   2.5 Solid Waste Pollution: 
      Sources, effects and treatment of solid wastes. (15)

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. (8)

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)

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)

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

7. Cleaner Production Technologies:
Need and benefits, cleaner production techniques and options, zero impact manufacturing initiatives CDM and carbon credits/case studies.

Practice Tasks:
1. Analysis of water for various parameters using spectrophotometer and flame photometry.
2. Determination of BOD for domestic waste/industrial waste.
3. Determination of MPN of given sample.
4. Air sampling and determination of standard particulate matter and other gaseous contaminants.
5. Measurement of CO₂, CO, NOₓ levels in ambient air by gas analyzer.
7. Determination of noise levels for indoor and outdoor noise.
8. Use of Atomic Absorption spectroscopy (Demonstration only).

Reference Books:
5. GN Panday, GC Carney Environmental Engineering, Tata McGraw Hill.
8. P Venugopala Rao; Text Book of Environmental engineering, PHI.
Objectives:

With the rapid growth in the automobile industry there has been a tremendous variation and deviation in the vehicular load and traffic volume on the road. With the increase in the axle load for carrying heavy loads depending upon the need of the industry in the urban and rural sector, it is important that the emphasis at post-graduate level be made on the design, construction and maintenance of national and state highways. The subject of pavement design, construction and maintenance will enable the students to design the flexible and rigid pavements, by different methods, airport pavements by LCN method, construction of highways which involves selection of materials & constructional procedures for different types of roads and maintenance of highways which shall include the causes of failures and their remedial measures.

CONTENTS

1. Introduction:
   Types of pavement structure, functions of pavement components. factors affecting pavement design.  

2. Design of Pavements:
   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 roads. 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

Practical Exercises:
i) Determination of CBR value of sub-grade soils. 
ii) Determination of stripping value of road aggregate.
iii) Study of Sensor- paver and other construction machinery
iv) Study of batching and mixing plant for construction of roads.
vii) Evaluation of pavement strength by using Benkelman's Beam.
viii) Determination of strength of existing pavement by Dynamic Cone Penetration Test.
viii) Roughness measurement of road surface

Reference Books:

1. Khanna and Justo; Highway Engineering, Nemchand & Bros. Roorkee
2. Clarkson H.Oglesby and Gary Hicks; Highway Engineering. John Wiley & Sons, London,
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
Objectives:

In the coming five year plan there is heavy emphasis on infra-structure development including the construction of highways of which construction of bridges forms an integral part. The subject of bridge engineering aims at providing knowledge concerning the standard specifications for road bridges, general arrangement and suitability of various types of RCC, PRC and steel bridges, design of substructure, construction details of shallow foundations, pile and well foundation for bridges, details of bearings, expansion joints, footpaths and handrails and construction and maintenance of bridges. The study of the subject will enable the students to acquire relevant knowledge for construction and maintenance of bridges.

CONTENTS

1. Introduction
   Definition; components of a bridge; classification; importance of bridges. (03)

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. (12)

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) (15)

4. Sub-Structure: Design of piers and abutments (Masonry & R.C.C). (04)

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. (07)

6. Bearings, Joints, and Handrails: Different types of bearings, joints and handrails. (04)

7. Construction and Maintenance of Bridges.
Reference Books:

3. Rangwala; Bridge Engg
4. Rowe, R.E., Concrete Bridge Design, John Wiley & Sons, Inc. New York
5. Raina, V.K., Concrete Bridges Practice Book, Tata McGraw Hill, New Delhi
8. IRC.78.200
9. IS 5050
10. IS 3955
Objectives:
In the construction of various civil engineering activities construction technology plays an important role. During the last five decades, construction industry has undergone large scale mechanization with rapid changes and advancements in construction practices. In order to bring professional in construction the subject of "Advanced Construction Technology" has been introduced at post graduate level. This subject will enable student to understand the concepts and principles of modern day construction in Earthen Dams, special foundations, High Rise Buildings, Prefabricated construction and Applications of Geo-synthetics.

CONTENTS

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.
References:

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
7) Bungale S Taranath; Structural Analysis and Design of Tall Buildings, Tata McGraw Hill
8) Monohar SN; Tall Chimneys-Design and Construction Tata McGraw Hill.
10) CBRI Roorkee, Advances in Building Materials and Construction.
11) Bohdan Lewicki Building with large Prefabricates, Elsevier Publishing Company
12) ASG Bruggeling GF Hugghe Prefabrication with Concrete, AA Balkema/ Rotterdam/Brookfield
CONTENTS

1. Learning : Concept and Types & Conditions of Learning (Gagne)  

2. Learning Theories :  
   a) Behaviourist Theories : Classical conditioning, Operant Conditioning, Social Learning Theory  
   b) Cognitivistic Theory : Information Processing Theory, Assimilation Theory, Attribution Theory, Elaboration Theory  
   c) Constructivist, Social and Situational Theories : Case-based Learning, Discovery Learning, Social Development Theory and Problem based Learning  
   d) Experential Learning  

3. Learning Strategies : Deep & Surface Approach to Learning, Rehearsal, Imagery, Mnemonics, Chunking, Concept maps, Metaphors, Analogies  

4. Instruction and Theories of Instruction : Cocept, Theories of Instruction : Bruner, Ausubel and Gagne  

5. Instruction Design and Development : Systematic Approach to Instructional Design, Development of Instructional Plans and Resources  


REFERENCE/RECOMMENDED BOOKS :  

CONTENTS

1. Introduction to ICT Enables Education
   Concept of ICT enabled education, advantages of ICT enabled education, ICT enabled education projects and applications, ICT-based Models of Learning;
   
   Learning through :
   • ‘Correspondence’
   • ‘Pressure Sensitive Blackboards’
   • ‘Video Taped Lectures’
   • ‘Interactive CDs’
   • ‘Web-based Courseware’
   • ‘Satellite delivered courses’
   • ‘Radio, Podcasting, Internet Radio’ and
   • ‘Blended Learning Modes’

3. ICT Enabled Web-based Learning through Internet
   Introduction to Internet, Internet, Addresses and Domain Names, Browsers, Search Engines, SCORM & AICC Standards, Protocols, E-learning & E-management., Virtual Classrooms, Digital Libraries & Repositories, CLMS, LMS, Moodle Software.
4. Collaboration Mechanisms
   - Collaboration mechanisms and Webcasts, screen sharing, Response pads, whiteboard, discussion groups, Podcasts, Blogs, Wiki, RSS feeds.
5. CAI & Multimedia :

REFERENCE / RECOMMENDED BOOKS :
5. Ranjan Parikh ‘Principles of Multimedia’.
CONTENTS

1. **History of Technical and Vocational Education in India**
   - Historical developments
   - National Policy on Education
   - Effect of Liberalisation, Privatisation and Globalisation (LPG) on TVE in India

2. **Educational Organisation**
   - Educational System and Infrastructure (central and state level)
   - Size and Growth in TVE and higher education
   - Technical and Vocational Sub-systems
   - Apprenticeship Board, Functions and its Act
   - Technical Teacher Training and Vocational Education
   - Aims and objectives of different levels of Technical education

3. **Policy, Planning and Administration**
   - Structural set up for Policy Making
   - National & State level Statutory and Advisory Bodies
   - Policy Making Process
   - Planning, Administration, Direction and Control
   - NBA, NAAC and Accreditation Process

4. **Major Issues, Challenges and Perspectives in Technical and Vocational Education**
   - Privatization of Technical and Vocational Education
   - Financing and Management
   - Quality Management and Assurance
   - World Bank Assisted Project for Technician Education (WBAP)
   - Technical Education Quality Improvement Programmes (TEQUIP)
   - Skill Development Initiatives of Govt. of India

5. **Emerging Trends and Future of Technical Education System**
   - Curriculum, Management, Instructional Methods, Evaluation, Resources

**Practice Tasks:**

1. Organizational structure of technical and vocational articulation between different sub-systems
2. SWOT analysis of technical education in India
3. A study on:
   - Shortcoming of existing technical and vocational education system
   - Future expectations from technical education in view of socio-economic scenario
4. Educational Policy Formulation – An Exercise.
5. Issues, Challenges and Perspectives of Technical and Vocational Education in India.
Recommended / Reference Books:

1. Chandrakant LS: Polytechnic Education in India, Bombay, DB Tara Porevola Sons and Company (c., 1971).
5. UNESCO, Studies in Technical and Vocational Education, United Kingdom, Germany, USA and Japan.