

**RAJIV GANDHI PROUDYOGIKI VISHWA VIDYALAYA, BHOPAL**

Credit Based Grading System

**Civil Engineering, VIII-Semester**

**CE-8001 Advance Structural Design –II (Steel)**

**Unit – I** Plate girder bridges (Riveted and welded)

**Unit – II** Trussed girder bridges for railways and highways (IRC & IRS holding). Bearings for bridges.

**Unit – III Water Tanks:** Pressed steel tanks, tanks with ordinary plates, square, rectangular, circular with hemispherical bottom and conical bottom.

**Unit – IV Chimneys:** Guyed and self supporting steel stacks.

**Unit – V** Bunkers, Silos & Towers

**Reference Books :-**

1. Design of Steel Structures – Ramammutham
2. Design of Steel Structures – Punia
3. Steel Str. by Ramchandra Vol II
4. Steel Str. by Arya & Ajmani
5. Design of steel structures – L.S. Negi

# **RAJIV GANDHI PROUDYOGIKI VISHWA VIDYALAYA, BHOPAL**

Credit Based Grading System

**Civil Engineering, VIII-Semester**

**CE-8002 GEO TECH. ENGG. – II**

**Unit – I Shallow Foundations :** Type of foundations shallow and deep. Bearing capacity of foundation on cohesion less and cohesive soils. General and local shear failures. Factors effecting B.C. Theories of bearing capacity - Prandle, Terzaghi, Balla, Skempton, Meyerh of and Hansan. I.S. code on B.c. Determination of bearing capacity. Limits of total and differential settlements. Plate load test.

**Unit – II Deep Foundation :** Pile foundation, Types of piles, estimation of individual and group capacity of piles in cohesion less and cohesive soils. Static and dynamic formulae.. Pile load test, Settlement of pile group, Negative skin friction, under- reamed piles and their design. Piles under tension, inclined and lateral load Caissons. Well foundation. Equilibrium of wells. Analysis for stability tilts and shifts, remedial measures.

**Unit – III Soil Improvement Techniques :** Compaction. Field and laboratory methods, Proctor compaction tests, Factors affecting compaction. Properties of soil affected by compaction. Various equipment for field compaction and their suitability. Field compaction control. Lift thickness.

Soil stabilisation : Mechanical, Lime, Cement, Bitumen, Chemical, Thermal, Electrical-stabilisation and sabilisation by grouting. Geo-synthetics, types, functions, materials and uses.

**Unit – IV Soil Exploration and Foundations on Expansive and Collapsible soils :** Methods of soil exploration. Planning of exploration programme for buildings, highways and earth dams. Disturbed and undisturbed samples and samplers for collecting them. Characteristics of expansive and collapsible soils, their treatment, Construction techniques on expansive and collapsible soils. CNS layer.

**Unit – V Sheet piles/Bulkheads and Machine foundation :** Classification of sheet piles/bulkheads. Cantilever and anchored sheet piles, Cofferdams, materials, types and applications.

Modes of vibration. Mass-spring analogy, Natural frequency. Effect of vibration on soils. Vibration isolation. Criteria for design. Design of block foundation for impact type of machine.

**LABORATORY WORK:** Laboratory work will be based on the course of Geotech. Engg. I & II as required for soil investigations of engineering projects and not covered in the lab. Work of Geotech. Engg. I.

**LIST OF EXPERIMENTS:**

1. Indian Standard Light Compaction Test/Std. Proctor Test
2. Indian Standard Heavy Compaction Test/Modified Proctor Test
3. Determination of field density by Core Cutter Method
4. Determination of field density by Sand Replacement Method
5. Determination of field density by Water Displacement Method
6. The corifiled Compression Test
7. Triaxial compression test
8. Lab. Vane Shear test
9. CBR Test
10. Demonstration of Plate Load Test SPT & DCPT

**References :--**

1. Soil Mechanics & Foundation Engg. by Dr. K.R. Arora - Std. Publishers Delhi
2. Soil Mechanics & Foundation Engg. by B.C. Punmia - Laxmi Publiscations Delhi
3. Modern Geotech. Engg. by Dr. Alam Singh-IBT Publishers Delhi.
4. Geotech. Engg. by C.Venkatramaiah-New AGE International Publishers, Delhi
5. Found. Engg. by GALEonards McGraw Hill Book Co. Inc.
6. Relevant IS Code

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

**Civil Engineering, VIII-Semester**

## **Elective-V CE-8003 (1) PRE-STRESS CONCRETE DESIGN**

**UNIT-I Introduction–Theory And Behaviour:** Basic concepts, Advantages, Materials required, Systems and methods of pre stressing – Analysis of sections, Stress concept, Strength concept, Load balancing concept, Effect of loading on the tensile stresses in tendons, Effect of tendon profile on deflections, Losses of pre-stress.

**UNIT-II Design Concepts:** Flexural strength, Simplified procedures as per codes, strain compatibility method, Basic concepts in selection of cross section for bending – stress distribution in end block, Design of anchorage zone reinforcement, Limit state design criteria, Partial pre-stressing Applications.

**UNIT III Pre-stressed Concrete Slabs:** One way slab two way slabs, pre-stressed concrete beam slab construction, pre-stressed flat slab, Deflection and Crack Width : Factors influencing deflection, short term deflections of un cracked members, long term deflection, deflections of cracked members.

**UNIT IV Miscellaneous Structural Members :** Columns subjected to combined bending and axial force, piles, poles, piers and abutments and Tension member-ring beams. Design of pre-stressed circular concrete tanks – Pipes

**UNIT V Pre-Stressed Concrete Bridges:** General aspects – pre-tensioned pre-stressed bridge decks – Post tensioned post-stressed bridge decks – Principles of design only.

### **References**

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, New Delhi 1998
2. Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co. Pvt. Ltd. 1997.
3. Rajagopalan, N, “Prestressed Concrete”, Alpha Science, 2002
4. Jain & Jai Krishna, Plain & Reinforced Concrete Vol – II Nem chand & Bros Roorkee.
5. P. Dayaratran, Pre-stressed Concrete Structures, Oxford & IBH Co. Delhi
6. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi, 1990
7. Lin T.Y. Design of prestressed concrete structures, Asia Publishing House, Bombay 1995.
8. David A. Sheppard, William R. and Philips, Plant Cast precast and prestressed concrete
9. IS 1343-980 code of Practice for Pre-stressed Concrete < Bureau of India Standards New Delhi

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

**Civil Engineering, VIII-Semester**

## **Elective-V CE-8003 (2) TRAFFIC ENGINEERING**

**Unit -I. Traffic Characteristics** : Road user's characteristics - general human characteristics, physical, mental and emotional factors, factors affecting reaction time, PIEV theory. Vehicular characteristics: Characteristics affecting road design-width, height, length and other dimensions. weight, power, speed and braking capacity of a vehicle.

**Unit -II. Traffic Studies** : Spot Speed Studies and Volume Studies. Speed and Delay Studies purpose, causes of delay, methods of conducting speed and delay studies. Origin and destination Studies ( O & D) : Various methods, collection and interpretation of data, planning and sampling. Traffic Capacity Studies: Volume, density, basic practical and possible capacities, level of service. Parking Studies: Methods of parking studies cordon counts, space inventories, parking practices.

**Unit -III. Traffic Operations And Control** : Traffic regulations and various means of control. One way streets-advantages and limitations. Traffic signals- isolated signals, coordinated signals, simultaneous, alternate, flexible and progressive signal systems. Types of traffic signals, fixed time signals, traffic actuated signals, speed control signals, pedestrian signals, flashing signals, clearance interval and problems on single isolated traffic signal.

**Unit -IV. Street Lighting** : Methods of light distribution. Design of street lighting system. Definitions- Luminaire, foot candle, Lumen, utilization and maintenance factors. Different types of light sources used for street lighting. Fundamental factors of night vision.

**Unit -V. Accident Studies & Mass Transportation** : Accident Studies : Causes of accidents, accident studies and records, condition and collision diagram, preventive measures. Expressways and freeways, problems on mass transportation and remedial measures, brief study of mass transportation available in the country.

**Reference Books :-**

1. Traffic Engineering and Transport Planning by L.R. Kadiyali, Khanna Publishers, Delhi
2. Traffic Engineering by Matson, W.S. Smith & F.W. Hurd
3. G.J. Pingnataro, Principles of Traffic Engineering
4. D.R. Drew, Traffic Flow Theory
5. W.R. Mchsn and R.P. Roess "Traffic Engg"
6. Wohl & Martin, Traffic System Analysis for Engineering & Planner

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

**Civil Engineering, VIII-Semester**

## **Elective-V CE-8003 (3) URBAN TRANSPORTATION PLANNING**

**Unit- I : Transportation Planning Process:** Definition of Study Area; Zoning Principles; Types of Surveys: Home Interview Studies, Commercial Vehicle Surveys, Road Side Interview Methods, Public Transport Studies, Land Use Inventory; O-D Matrix and Desire Line Diagram. Accident Studies & Mass Transportation : (i)Accident Studies : Causes of accidents, accident studies and records, condition and collision diagram, preventive measures. (ii) Expressways and freeways, problems on mass transportation and remedial measures, brief study of mass transportation available in the country.

**Unit – II : Trip Generation:** Four Stage UTP Process; Travel Demand Models; Sequential Models and Direct Demand Models; Factors affecting Travel Demand; Trip Generation; Multiple Regression Analysis; Category Analysis; Aggregate and Disaggregate Models. TRIP Distribution: Trip Distribution Models- Growth Factor Models: Uniform Growth Factor, Average Growth Factor, Fratar Method and Furness Method; Limitations of Growth factor Models; Gravity Model – Calibration of Gravity Model.; Opportunity Models. Traffic Assignment: Purpose of Traffic Assignment; Assignment Techniques-All-or-Nothing Assignment, Multiple Route Assignment, Capacity restraint assignment; Use of Diversion Curves in Assignment.

**Unit –III : Mode Split:** Factors affecting Mode Split; Pre–distribution Mode Split; Post-Distribution Mode Split; Advantages and Disadvantages; Probit, Logit and Discriminant Analysis in Mode Split. Land use and transportation system: Urban system components, Concept and definitions, criteria for measuring and comparing urban structure, land use and transportation.

**Unit – IV : Pavement Design Factors:** Design wheel load, strength characteristics of pavement materials, climatic variations, traffic - load equivalence factors and equivalent wheel loads. Flexible Pavements Design: Component parts of the pavement structures and their functions, stresses in flexible pavements, Stress distribution through various layers, Boussinesque's theory , Burmister's two layered theory, methods of design, Group Index method, CBR method, IRC method, AASHTO method, Burmister's method and North Dakota cone method. Applications of pavement design software.

**Unit –V : Rigid Pavements:** Evaluation of sub grade, Modulus-K by plate bearing test and the test details, Westergaard's stress theory stresses in rigid pavements, Temperature stresses, warping stresses, frictional stresses, critical combination of stresses, critical loading positions. Rigid Pavement Design: Types of joints and their functions, joint spacing; design of CC pavement for roads, highways and expressways as per IRC, AASHTO, design of joints. Design of continuously reinforced concrete pavements. Reliability; Use of software for rigid pavement design.

## References

1. Adib Kanafani.(1983). Transportation Demand Analysis. Mc Graw Hill Series in Transportation, Berkeley.
2. Hutchinson, B.G. (1974). Principles of Urban Transport Systems Planning. Mc Graw Hill Book Company, New York.
3. John W.Dickey. (1975). Metropolitan Transportation Planning. Mc Graw Hill Book Company, New York.
4. Papacostas, C.S., and Prevedouros, P.D. (2002). Transportation Engineering and Planning. 3rd Edition, Prentice - Hall of India Pvt Ltd., 318-436.
5. Khisty C.J., Transportation Engineering - An Introduction, Prentice Hall, India, 2002.
6. Yoder and Witczak, Principles of Pavement Design, John Wiley and Sons
7. Yang. H. Huang, Pavement Analysis and Design, Second Edition, Prentice Hall Inc.
8. Rajib B. Mallick and Tahar El-Korchi, Pavement Engineering – Principles and Practice, CRC Press (Taylor and Francis Group)
9. W.Ronald Hudson, Ralph Haas and Zeniswki , Modern Pavement Management, Mc Graw Hill and Co Academic Session 2016-17
10. Relevant IRC Codes
11. Bruton M J (1981), "Introduction to transportation planning", Hutchinson of London
12. Dickey J W(1980), "Metropolitan Transportation Planning", Tata McGraw Hill
13. Principles of Transportation Engineering : P. Chakraborty and A. Das
14. Fundamentals of Transportation Engineering: : C.S. Papacoastas
15. Traffic Engineering and Transport Planning: : L.R. Kadyal



# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

**Civil Engineering, VIII-Semester**

## **Elective-V CE-8003 (4) DISASTER RISK MANAGEMENT**

**UNIT 1:** Understanding Disasters: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management

**UNIT 2:** Types, Trends, Causes, Consequences and Control of Disasters: Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters

**UNIT 3:** Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, Zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action

**UNIT 4:** Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter-governmental Agencies

**UNIT 5:** Applications of Science and Technology for Disaster Management: Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India, Role of Engineers in Disaster Management

## References

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
3. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
4. World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
5. Encyclopedia of disaster management, Vol I, II and III. Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
6. Encyclopedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
7. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
8. Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
10. Disaster Management Act 2005, Publisher by Govt. of India

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

**Civil Engineering, VIII-Semester**

## **Elective-VI CE-8004 (1) SUSTAINABLE DESIGN AND CONSTRUCTION**

**Unit – I: Housing Scenario:** Introducing, Status of urban housing, Status of Rural Housing. b) Housing Finance: Introducing, Existing finance system in India, Government role as facilitator, Status at Rural Housing Finance, Impedimental in housing finance and related issues. (c) Land use and physical planning for housing: Introduction, Planning of urban land, Urban land ceiling and regulation act, Efficiency of building bye laws, Residential Densities.

**Unit – II : Development and adopting sustainable construction technology:** Introduction, Adoption of innovative cost effective construction techniques, Adoption of pre-cast elements in partial prefabrication, Adopting of total prefabrication of mass housing in India, General remarks on pre cast roofing/flooring systems, Economical wall system, Single Brick thick load bearing wall, 19cm thick load bearing masonry walls, Half brick thick load bearing wall, Fly ash-gypsum brick for masonry, Stone Block masonry, Adoption of pre-cast R.C. plank and join system for roof/floor in the building.

**Unit – III : Alternative building materials for sustainable construction:** Introduction, Substitute for scarce materials, Ferro-cement- Gypsum boards, Timber substitutions, Industrial wastes, Agricultural wastes, cement-soil blocks for masonry, stabilized mud construction Low cost Infrastructure services: Introducing- Present status- Technological options- Low cost sanitation's Domestic wall- Water supply- energy.

**Unit – IV: Housing the urban poor:** Introduction, Living conditions in slums, Approaches and strategies for housing urban poor. Rural Housing: Introduction, traditional practice of rural housing continuous, Mud Housing technology, Mud roofs, Characteristics of mud, Fire resistant treatment for thatched roof, Soil stabilization, Rural Housing programs.

**Unit – V: Construction in Disaster Prone areas:** Introduction, Earthquake, Damages to houses, Traditional Housing in disaster prone areas, Type of Damages of non-engineered buildings, Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions, Requirements of structural safety of thin pre-cast roofing units against earthquake forces, Status of R& D in earthquake strengthening measures, Floods- cyclone, future safety.

**Reference Books:-**

1. Building materials for low-income houses – International council for building research studies and documentations.
2. Hand book of low cost housing by A.K.Lal – Newage international publishers.
3. Properties of Concrete – Neville A.M. Pitman publishing Limited- London.
4. Light weight concrete- Academic kiado- Rudhai .G – Publishing home of Hungarian Academy of Sciences 1963.
5. Low cost Housing – G.C. Mathur
6. Modern trends in housing in developing countries – A.G. Madhava Rao- D.S. Ramachandra Murthy & G.Annamalai.

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**Civil Engineering, VIII-Semester**

## **Elective-VI CE-8004 (2) WASTE DISPOSAL & MANAGEMENT**

**UNIT – I Solid Waste And Its Management:** Introduction to solid waste-Definition of solid waste, garbage, rubbish-Sources and Types. Characteristics of Solid Wastes: Physical, chemical and biological characteristics. 3Rs- Reduction, reuse, recycling and recovery principles of waste management- Functional elements of Solid Waste management- Waste generation and handling at source-Collection of solid wastes- Collection methods and services- guidelines for collection route layout.

**UNIT- II Waste Water And Its Management:** Characteristics and analysis of waste water, recycles of decomposition, physical, chemical & biological parameters. Unit operations for waste water treatment, preliminary treatment.

**UNIT- III Hazardous Waste And Its Management:** Introduction to hazardous waste management issues, classification; Magnitude of problem; Risk assessment; Environmental Legislation; Characterization and site assessment; Waste minimization and resource recovery; Storage and Transportation of Hazardous wastes; Hazard in processing and treatment; Physical, Chemical, Thermal and Biological processes;

**UNIT –IV Transfer And Transport Of Wastes:** Solid Waste transportation: Transfer station- Processing and segregation of the solid waste- various methods of material segregation. Hazardous waste transportation: According to economic benefits, transfer stations, and types of hazardous waste.

**UNIT –V Disposal Of Wastes:** Solid waste disposal: Volume reduction, Open dumping, land filling techniques. Landfills: classification-Design and Operation of landfills, Land Farming, Deep well injection. Hazardous waste disposal; Landfill disposal and land storage; Ground water contamination; Containment; remedial alternatives. Natural methods of waste water disposal i.e. by land treatment & by dilution, self purification capacity of stream, Oxygen sag analysis.

### **Reference Books :-**

1. Waste Water Engg. by B.C. Punmia - Laxmi Publication (P) Ltd. New Delhi
2. Environmental Engg. - M.L. Davis & D.A. Cornwell - Mc Graw Hill Company
3. Integrated Solid Waste Management by Tchobanogous
4. Environmental Engineering by Howard S. Peavy, Donald R. Rowe and George.
5. Hazardous Waste Management by Charles A. Wentz - - Mc Graw Hill Company
6. Hazardous Waste Management [Gaynor W. Dawson](#), [Basil W. Mercer](#)

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Credit Based Grading System

**Civil Engineering, VIII-Semester**

## **Elective-VI CE-8004 (3) GEO-INFORMATICS**

**UNIT I Basic Concepts Of Gis Basics of Geographic Information System (GIS):** , Definition, Evolution & Components. GIS data input devices like scanner, digitizer, GPS, Remote sensing etc. Manual and semi-automatic line following digitization. Data Model: Raster Data Model, Grid , Tessellations. Spatial and attribute data visualization and query. Open GIS consortium, Customization in GIS , Object Oriented GIS, Web GIS, Introduction to popular GIS software like Arc GIS and QGIS.

**UNIT II Geo Informatics In Urban Mapping And Management:** Remote sensing for detection of urban features. Introduction & basic terminology. Digital image processing techniques – Case studies. Segmentation of Built-up areas – Classification algorithms – Land use/ Land cover mapping – change detection – high resolution remote sensing – case studies. Mapping transportation network – Alignment planning – Traffic and parking studies – Accident analysis – case studies. Urban growth modeling – Expert systems in planning.

**UNIT III Basic Concepts Of Photogrammetry :**History and development:- Types of aerial photo, Classification of aerial cameras, Scale, Overlaps, Stereoscopy, Concepts, Viewing and measuring systems, Image and object coordinates, floating mark, parallax equation, height information, Tilt , Rectification , Displacement. Flight planning, computation for flight plan, photo control, cost estimation, aerial mosaics, types. Concepts of interior, relative, absolute orientation, object, image relation, linearization, effect of orientation elements , scaling and leveling , analytical procedures , map compilation using stereo plotters.

Introduction to digital photogrammetry, Elements of Aero triangulation and analytical method, strip and block adjustment, Terrestrial photogrammetry.

**UNIT IV GPS Surveying:** Introduction & components of GPS, Space segment, control segment and user segment, Elements of Satellite based surveys-Map datums, GPS receivers, GPS observation methods and their advantages over conventional methods.

**UNIT V Remote Sensing:** Principle, components, classification, application on environmental engineering, hydrology and water resources , agriculture & forestry, disaster management.

**Microwave Remote Sensing:** Introduction, basic concepts, terminology and sensors in MWRS. Radar basics, radar interaction with earth surface ,geometry of radar images, radar return and image signature, resolution concepts.

## REFERENCES

- 1.Plane Surveying- A. M. Chandra, New Age International.
- 2.Surveying and Leveling-Part-I & IIT- P. Kanetkar and S. V. Kulkarni, Vidyarthi Griha Prakashan.
- 3.Geoinformation: Remote Sensing, Photogrammetry and Geographic Information Systems- Gottfried Konecny, CRCPress
- 4.Elements of Photogrammetry- Paul R.Wolf, McGraw-Hill
- 5.Photogrammetry, Vol 1&II - Karl Kraus, Walter de Gruyter
- 6.Remote Sensing and image interpretation- Lillesand T.M. and Kiefer R. W., Willey.
- 7.Introduction to remote sensing - J. B. Campbell, John Willey.
- 8.Introductory digital image processing- J. R., Jensen Prentice Hall.
- 9.Remote Sensing in Civil Engineering- Kennie, T. J. M. and Matthews M. C., Surrey University Press.
- 10.GPS satellite surveying- Alfred Leick,.Wiley
- 11.GPS Theory, Algorithms and Applications- GuochengXu, Springer
- 12.Microwave remote sensing vol-1,vol-2- Ulaby,F.T.,Moore,K.R. and Fung,Artech House Publishers.
- 13.Principles and applications of Imaging - Floyd. M. Handerson Anthony, J.Lewis, Wiley.
- 14.Air and space borne radar systems-An introduction- Philippe Lacomme and Eric Normant, Elsevier.
- 15.Introduction to microwave remote sensing- Iain H.woodhouse,CRCPress
- 16.Satellite Remote Sensing for Hydrology and Water Management- Eric C. Barrett, Clare H.Power, Taylor & Francis Ltd
- 17.Hydrologic and Hydraulic Modeling Supportwith Geographic Information Systems- Dr. David Maidment, Dr. Dean Djokic, Esri Press.

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Civil Engineering, VIII-Semester

## Elective-VI CE-8004 (4) Finite Element Method

**UNIT-I:Introduction to Finite element method:** General applicability and description of finite element method, comparison with other methods.

**UNIT-II:Solution of finite element method:** Solution of equilibrium problems, eigen value problems, propagation problems, computer implementation of Gaussian eliminations, Choleskis decomposition, Jacobis and Ranga-Kutta method.

**UNIT-III:General procedure of finite element method:** Descretization of the domain, selection of shapes, types and number of elements, node numbering technique, interpolation, polynomials, their selection and derivation in terms of global and local coordinates, convergence requirements. Formulation of element characteristic matrices and vectors, variational approach.

**UNIT-IV:Iso-parametric formulation:** Lagrange and Hermite interpolation functions, iso-parametric elements, numerical integration.

### UNIT-V

**Static analysis:** Formulation of equilibrium equation, analysis of truss, frames, plane stress and plane strain problems.

Reference Books:

1. Weaver, Johnson, Finite element and structural analysis
2. HC Martin, Matrix structural analysis
3. CF Abel, CS Desai, Finite element methods
4. Buchanan, Finite element Analysis (Schaum Outline S), TMH
5. Krishnamurthy, Finite element analysis, TM



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**Civil Engineering, VIII-Semester**

**CE-8006 NON-DESTRUCTIVE TESTING(NDT)**

**List of experiment:**

1. To study of Rebound Hammer Test.
2. To study of UPV Test.