SCHEME OF INSTRUCTION AND EXAMINATION
BE IV/IV YEAR (REGULAR)
(CIVIL ENGINEERING)

SEMESTER – I

S. No	Syllabus Ref. no.	Subject	Scheme of Instruction		Scheme of Examination		
			Periods per Week		Duration in Hours	Maximum Marks	
			L/T	D/P		Univ. Exam	Sessional
THEORY							
1	CE 401	Structural Engineering Design and Detailing – II (Steel)	4	2	3	75	25
2	CE 402	Estimating & Specifications	2	3	3	75	25
3	CE 403	Foundation Engineering	4	-	3	75	25
4	CE 404	Water Resources Engineering & Management – II	4	-	3	75	25
5	CE 405	Concrete Technology	4	-	3	75	25
6		Elective –I	4	-	3	75	25
PRACTICALS							
7	CE 431	Concrete Laboratory	-	3	3	50	25
8	CE 432	Computer Applications Laboratory	-	3	3	50	25
9	CE 433	Project Seminar	-	2	-	-	25
		Total	**22**	**13**	**-**	**550**	**225**
		Total		**35**			**775**

Elective 1

CE 406 Elements of Earthquake Engineering
CE 407 Surface & Ground Water Management
CE 408 Pre-Stressed concrete
CE 409 Geographical Information systems
CE 410 Operation Research in Civil Engineering
ME 411 Entrepreneurship

CE 401

STRUCTURAL ENGINEERING DESIGN AND DRAWING - II (STEEL)

Instruction	6 Periods per week (4 Theory + 2 Tutorials)
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT - I

Plate Girder: Limit State Design of riverted and welded plate girder for static loads – including flange curtailment, connections, Intermediate and bearing stiffeners, Web and flange splice.

UNIT - II

Crane and Gantry girders: Basic Principles, Codal Provisions, Limit state design of single bay portal with and without crane including detailing.

Bearings: Types – Rocker and Roller – Elastic Design of bearings for bridges.

UNIT - III

Bridges: Deck and through type bridges – Economical span – Indian standard Railway broad gauge train loadings – permissible stresses – Detailed design and drawing of plate girder and truss bridges using elastic design.

Suggested Reading:

1. Subramanian, N, “Limit State Design of Steel Structures”, Oxford University Press, 2008.
2. Duggal, S.K., “Limit State Design of Steel Structures”, Tata McGraw Hill Publications, 2009.
3. Bhavikatti, S.S., “Design of Steel Structures”, I.K. International Publishing House Pvt. Ltd, 2010.
4. Shiyekar, M.R. “Limit State Design of Structural Steel”, PHI Learning Private Limited.
5. Arya A.S. and Ajmani J.L., “Steel Structures”, Nem Chand & Bros. 1992.

CE 402

ESTIMATING AND SPECIFICATIONS

Instruction	6 Periods per week (4 Theory + 2 Tutorials)
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT - I. **Working out the detailed estimate for the following**:

i. Flat roof building (load bearing, RCC & Steel framed structure)

ii. Bituminous and C.C Road work including earthwork

iii. Single pipe culvert and single cell rectangular box culvert

iv. Septic tank

v. Irrigation canal work including earthwork

UNIT – II Estimation of steel quantities for the following R.C. Works

i. Slabs, Beams and Columns

ii. Footings – Rectangular, Isolated and combined

iii. Stair Case

iv. Overhead rectangular water tank

UNIT – III Preparation of analysis of rates and theoretical requirements of materials as per the standard data of APDSS for the following:

i. Major items of works of a building

ii. All items of work of bituminous and concrete road works.

UNIT – IV As per APDSS

i. General and detailed specification of works

ii. Departmental procedure for construction work

iii. Types of estimates

UNIT – V :

i. Types of contracts, essentials of contract, condition of contract and recent developments

ii. Tender – Tender form, Tender Documents, Tender Notice, e-ternder, work order

iii. Earnest Money, Security Deposit and new developments

iv. Measurement Book and muster roll. Concept of PPP projects, BOT and BOOT projects.

Suggested Reading:

1. B.N.Dutta, *Estimating and Costing in Civil Engineering – Theroy and Practice*, S.Dutta & Co., Lucknow, 2002.
2. M.Chakraborthi, *Estimating, Costing and Specifications in Civil Engineering*, (Published by Author), 2002
3. Jagjit Singh, *Estimating and Costing in Civil Engineering*, Galgotia Publications, New Delhi, 1996.
4. Patil, B.S. (2009), *Civil Engineering Contracts and Estimation*, Universities Press, III Edition, Hyderabad.

CE 403

FOUNDATION ENGINEERING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Stress Distribution in Soils: Boussinesq's and Westergaurd's equations for point load. Application of point load formulae for uniformly distributed load on circular and rectangular areas. Use of Newmark's chart (for Boussinesq's equation). Contact pressure distribution.

Unit-II

Bearing Capacity of soils: Terzaghi's equation for bearing capacity in soils – it's modification for continuous, square, rectangular and circular footings, general and local shear failure conditions. Plate load test as per IS specification. Allowable bearing capacity. Standard penetration test and use of N values for estimating soil conditions and bearing capacity. Proportioning of footings.

Settlement Analysis: Computation of pressures before loading and after loading. Estimation of settlement – ultimate and after any given period. Correction for construction period.

Unit-III

Pile Foundations: Types of piles – timber, steel, concrete, cast-in-situ, precast piles, bearing piles, friction piles, compaction piles, large diameter piles. Pile capacity – static formulae, dynamic formulae, pile load test, determination of point resistance and skin friction as per IS code. Bearing capacity of pile groups, negative skin friction.

Unit-IV

Coffer Dams: Earth embankments, Cantilever sheet files, braced coffer dams, double wall coffer dams, cellular dams – circular, diaphragm type, general description and construction methods.

Cassions: Types of cassions – open, pneumatic and box cassions (floating cassions). General description and construction methods – Types and uses. Different shapes of wells, Design of individual components of the well, sinking of wells, Measures for rectification of tilts and shifts.

Unit-V

Dewatering Techniques: Sumps, ditches, well points, deep wells.

Timbering of Excavation: Bracings for shallow and deep excavation. Computation of lateral earth pressure. Reactions of struts.

Site investigation: Principles of exploration, sampling methods, transportation and storage of samples, boring and drilling methods, log of bore holes, sampling tubes and samplers. Sampling records.

Suggested Reading:

1. Prakash Shamsher, Ranjan T.Saran S, *Analysis and Design of Foundations & retaining structures*, Sarita Prakashan, Merrut, 1979.
2. Bowles Joseph E., *Foundation Analysis and Design*, McGraw Hill Pub. 2000.
3. Swami Saran, *Analysis and Design of Sub Structure*, Oxford & IBH, 1998.
4. Dr. K.R. Arora, *Soil Mechanics and Foundation Engineering*, Standards Pub. 2002.

CE 404

WATER RESOURCES ENGINEERING – II

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Types of reservoirs, Selection of site, Storage capacity analysis, Reservoir sedimentation, Flood routing through retarding basin.

UNIT-II

Storage Head Works: Types of dams, advantages & disadvantages, selection criteria, Economical Height of the Dam, Gravity dam, Forces acting on dam, stability analysis, Principal stresses, Elementary Profile and Practical Profile, Low and High gravity dams.

UNIT-III

Earth dams: Types, Methods of construction, Seepage analysis for homogenous and Zoned embankment dams, Drainage in embankment dams, various types of filters, Failure of Earth dams & Design criteria.

UNIT-IV

Spill Ways & Energy Dissipation: Types of Spill Ways, Ogee Spill Ways, Design of Ogee Profile, Fixation of levels, Syphon Spill Way & Chute Spill Way. Energy Dissipators, Hydraulic Jump & Bucket type dissipators, Tail Water Rating Curve & Jump Height Curve.

UNIT-V

Water Power Engineering: History, demand and generation, flow duration curve, types of Hydel Plants, Water Conveyance, Penstocks & Surge Tanks, power house layout and components-their functions

Suggested Reading:

1. Modi, *Irrigation & Water Resources and Water Power*, Standard Publishers, New Delhi.
2. Ralph W.Warbs and W.P.James, *Water Resources Engineering,* Prentice Hall, New Delhi.
3. B.C. Punmiya & B.B. Lal, *Irrigation & Water Power Engineering*, Laxmi Publishers.
4. S.K. Garg, *Irrigation Engg. & Hydralic Structures*, Khanna Publishers
5. Dandekar & Serma, *Water power Engineering*, Vikas Publishers, New Delhi.

CE 405

CONCRETE TECHNOLOGY

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Review of materials of Concrete

Properties of Fresh Concrete: Mixing and batching. Workability, factors effecting workability, Measurement of workability, various tests - Segregation and bleeding. Vibration of concrete. Types of vibrators and their influence on composition.

Properties of Hardened Concrete: Maturity concept Strength of concrete – factors effecting strength, Short terms and long term properties of concrete – Tests – Relationship between various mechanical strengths of concrete. Curing of concrete. Methods of curing. Stress-Strain curves for concrete.

Unit-II

Mix design of concrete: Basic consideration. Process of mix design. Factors in the choice of mix proportions and their influence. Quality control. Various methods of mix design. I.S.Code method. British and ACI methods.

Unit-III

Admixtures in concrete: Classification of admixtures. Chemical and mineral admixtures. Influence of various admixtures on properties of concrete. Applications. Concept of ready mixed concrete. Fly ash concrete – properties and proportion of fly ash, applications. Durability of concrete.

Unit-IV

High Strength and High Performance concrete: Design of High strength concrete. Light weight concrete and High density concrete – specialties and applications.

Recycled aggregate concrete - Concept, properties and applications.

Unit-V

Fibre Reinforced Concrete: Need for Fibre reinforced concrete (FRC), Mechanism of FRC, types of fibres, fibre shotcrete. Ferro cement

Self Compacting Concrete – Design Principles, Properties and applications

Quality Control aspects of Concrete.

Suggested Reading:

1. Neville A.M., *Properties of Concrete*, English Language Book Society / Longman Publications, 1998.
2. Mehta P.K., and Paulo J.M.M., *Concrete-Microstructure-Properties and Material*, McGraw Hill Publishers, 1997.
3. Krishnaraju N., *Design of Concrete Mix*, CBS Publishers, 1985.
4. Gambhir M.L., *Concrete Technology*

CE 431

CONCRETE LABORATORY

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks

1. (a) Determination of specific gravity of cement.
   (b) Determination of unit weight or bulk density of cement.

2. Determination of normal consistency of cement.

3. (a) Determination of initial setting time of cement.
   (b) Determination of final setting time of cement.

4. (a) Preparation of mortar cubes for compressive strength.
   (b) Test on mortar cubes for compressive strength.

5. To find fineness of cement by sieving and by air permeability method.

6. (a) Determination of specific gravity of fine aggregate.
   (b) Determination of bulk density of fine aggregate.

7. (a) Determination of specific gravity of coarse aggregate.
   (b) Determination of bulk density of coarse aggregate.

8. Test on bulking of sand.
   (a) Laboratory method.
   (b) Filed method.

9. Determination of fineness modulus of fine aggregate.

10. Determination of fineness modulus of coarse aggregate.

11. Study on workability test
    (a) Slump.
    (b) Compaction factor.

12. Tests on hardened concrete
    (a) Compressive Strength.
    (b) Flexural Strength.

13. Non-Destructive Testing of Concrete Structures (only demonstration)

CE 432

COMPUTER APPLICATIONS LABORATORY

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks

1. Design of a singly and doubly reinforced RCC section.
2. Design of circular sewer.
3. Analysis of continuous beams using flexibility method
4. Analysis of continuous beams by stiffness method
5. Analysis of plane trusses by stiffness method
6. Deflection of simply supported beams using finite difference method
7. Finite difference solution for equation of one dimensional consolidation
8. Finite difference approach for solution of Laplace equation
9. Determination of pressure bulb underneath a footing using Boussinesq's equation
10. Selection of optimal pipe diameter for turbulent flow
11. Introduction to Structural analysis software like STAAD Pro – Analysis of simple problems
12. Introduction to MS EXCEL – Solution of simple problems of structural analysis.

CE 433

PROJECT SEMINAR

Instruction	3 Periods per week
Sessional	25 Marks

Objective of the project seminar is to actively involve the students in preparation of the final year project with regard to following components:

1. Problem definition and specification.
2. Literature survey, familiarity with research journals.
3. Broad knowledge of available techniques to solve a particular problem.
4. Planning of the work, preparation of bar (activity) charts.
5. Presentation – oral and written.

The department can initiate the project allotment procedure at the end of III year 2nd semester and finalise it in the first two weeks of IV year 1st semester.

First 4 weeks of IV year 1st semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R & D institutions. The objective of these preliminary talks will be to expose the students to real life practical problems and methodology to solve the technical problems.

Seminar schedule will be prepared by the co-ordinator for all the students from 5th week to the last week of the semester which should be strictly adhered to.

Each student will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 20 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

ELECTIVE - I

CE 406

ELEMENTS OF EARTHQUAKE ENGINEERING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Engineering Seismology: Causes of earthquakes – Seismic waves – Magnitudes, intensity and energy release – characteristics of strong earthquakes, ground motions, soils effects and liquefaction.

Unit-II

Theory of Vibrations: Introduction, long and short period structure; single, two and multi-degree of freedom systems, damped and undamped variations, concepts of damped and undamped vibrations, response spectrum – Response spectrum analysis.

Unit-III

Seismic Design Philosophy: Concept of Seismic resistant design, reduction factors – Over strength, Ductility and Redundancy – Determination of earthquake forces on structures. Seismic Design and detailing of Masonry, Reinforced Concrete, and Steel Buildings.

Unit-IV

Seismic Performance of Buildings: Case Studies of few serious earthquakes in the country in the past, damages to buildings – Damage Patterns – Performance of Non-Engineered Buildings, Rural houses during the Earthquakes.

Unit-V

Seismic Resistant Design: Basic Principles of Earthquake resistance. Concepts of earthquake resistant construction in rural areas. Base isolation and energy dissipation devices. Seismic retrofitting – Repair, rehabilitation and retrofitting, retrofitting strategies – Importance of reanalysis. Case studies

Suggested Reading:

1. A.K.Chopra, Dynamics of Structures, Theory and Applications to Earth Quake Engineering, Pearson Education, 2004.
2. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall of India, 2006.
3. S.L.Kramer, Geotechnical Earthquake Engineering, Pearson Education, 2004.
4. Mario Paz, International Handbook of Earthquake Engineering: Codes, Programs and Examples, Springer Verlag, 1995.
5. D.S.Prakash Rao, Design Principles and Detailing of Concrete Structures, Tata McGraw-Hill Publishing Company, 1995.

ELECTIVE - I

CE 407

SURFACE & GROUND WATER MANAGEMENT

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Planning and Analysis of Water resource system: Introduction to water resource planning, water resource systems, characteristics of systems analysis and application.

Unit-II

Identification and Evaluation of Water Management Plans: Introduction, plan formulation, planning models and solution procedures, objective functions and constraint equations, lagrange multipliers, slack and surplus variables, dynamic programming, recursive equations.

Linear programming – General approach; geometrical approach and interpretation. Simulation – Definition, types of simulation models.

Unit-III

Management of ground water: Introduction, concepts of basin management, equation of hydrologic equilibrium, ground water basis investigations, data collection and field work, alternative basin yield evaluation of perennial yield, salt balance, basin management and conjugative use, example of ground water management. Salinity and water logging problems.

Unit-IV

Artificial Recharge of Ground Water: Introduction, concept artificial recharge, recharge methods, waste water recharge for reuse, recharge mounds, induced recharge.

Unit-V

Modelling Techniques and Applications: Introduction, porous media models – Sand tank model, analog models – Viscous fluid model, membrane models. Thermal models, blotting paper models. Dynamic Programming – application to reservoir operation and irrigation operation models. Linear Programming – Application to a water resource problem.

Suggested Reading:

1. Danierl P. Loucks, Jerry R. Stedinger, Douglas A. Haith, Water Resources Planning and Analysis, Prentice Hall, Inc. Englewood Cliffs. NY.
2. David Keith Todd, Ground Water Hydrology, John Wiley & Sons. NY.
3. Singiresu S Rao, Engineering Optimisation – Theory and practice. New Age International (P) Ltd.
4. Hall. W.A., Dracup, J.A., Water Resources Systems Engineering, McGraw Hill Book Co., NY

ELECTIVE - I

CE 408

PRE-STRESSED CONCRETE

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction: Basic Concepts, materials, permissible stresses – systems of prestressing. Losses of prestress in pre-tensioned and post-tensioned members.

Unit-II

Design: Analysis and Design of PSC beams for flexure using elastic analysis of simple and composite sections.

Unit-III

Design of sections for flexure: Design of R.C. section by Elastic theory for flexure.

Design for Shear: Shear and principles stresses, Design of R.C. section for shear, cracked and uncracked sections - codal provisions.

Unit-IV

Deflections: Importance of deflections, factors influencing deflections, codal provisions, short terms and long-term deflections – computation. Cable profiles, Kern points, limiting points – load balancing method, problems on load balancing method.

Unit-V

End Blocks: Nature of stresses, stress distribution – Magnel and Guyon's Methods – codal provisions – Design by Guyon's method.

Continuous Beams: Advantages of continuous members – codal provisions – analysis of two span continuous beams – concordant cable profiles.

Suggested Reading:

1. N.Krishna Raju, Pressed Concrete, Tata McGraw Hill, 2001.
2. G.S. Pandit and S.P. Gupta, Pressed Concrete, CBS Publications, 1995.
3. Dayaratnam, Prestressed Concrete, Oxford & IBH Publications.

ELECTIVE - I

CE 409

GEOGRAPHICAL INFORMATION SYSTEMS

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction: Map, definitions, representations-Point, line, polygon, common coordinate systems, Map projections – Transformations – Coordinate system – Map Analysis. History of development of GIS - Standard GIS packages.

Applications of GIS: Soil and water resources, Agriculture, Land use planning, geology and Municipal applications, Using GIS for decision making under uncertainty.

Unit-II

Data Entry, Storage and Maintenance: Data types – spatial, non-spatial (attribute data) – data structure, data format – point line vector – Raster – Polygon – Object structural model –filters and files data in computer – Keyboard entry, Manual Digitizing, Scanner, Remotely sensed data, Existing Digital data Cartographic database, Digital elevation data, data compression.

Unit-III

Data Analysis and Modelling: Spatial analysis, data retrieval, query (SQL) – Simple analysis, Recode overlay, Vector data analysis, Raster data analysis – Modeling in GIS – Digital elevation model – Cost and path analysis – Knowledge based systems.

GIS Analysis Functions: Organizing data for analysis, classification of GIS, analysis function, maintenance and analysis of spatial data – transformations, conflation, edge matching and editing. Maintenance and analysis of non-spatial attribute data – editing and query functions.

Unit-IV

GIS Analysis Function for Integrated Analysis of Spatial and Attribute Data: Retrieval and classification functions: overlay operations, neighborhood operations, connectivity functions, output formatting, Map annotations text pattern and line styles, graphic symbols, cartographic molding by GIS analysis procedure with an example.

Presentation of Geo-data and Analysis: Types of output data – Types of errors elimination and accuracies – sampling – Components of data quality.

Unit-V

Introduction to Remote Sensing: Electro magnetic radiation, characteristics, interaction with earth surface, sensors types, satellite characteristics IRS series, data products interpretation of data. Software Scenario Functions: Watershed modeling, Environmental modelling and Visibility analysis.

Suggested Reading:

1. Kang-Tsung Chang, *Introduction to GIS*, Tata McGraw Hill Edition.
2. Burrough, P.A., *Principles of GIS for land resource assessment,* Oxford publication.
3. Lillysand Johnweily, *Remote Sensing and Image Interpretation*.
4. Stan, *Geographic Information Systems A management perspective*.

ELECTIVE-I

ME 411

ENTREPRENEURSHIP

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and economic growth. Small Scale industry in India, Objectives, Linkage among small, medium and heavy industries. Types and forms of enterprises.

Unit-II

Identification and Characteristics of Entrepreneurs: Emergence of first generation entrepreneurs, environmental influence and women entrepreneurships. Conception and evaluation of ideas and their sources. Choice of technology – Collaborative interaction for technology development.

Unit-III

Project Formulation: Analysis of market and demand. Financial and profitability analysis and Technical analysis. Project financing in India.

Unit-IV

Project Management: Project organization, project planning and control using CPM, PERT techniques. Human aspects of project management. Assessment of tax burden.

Unit-V

Behavior Aspects of Entrepreneurs: Personality – determinants, attributes and models. Leadership concept and models. Values and attitudes. Motivation aspects, Change behavior. Time management. Various approaches of time management, their strengths and weaknesses. Urgency addition and time management matrix.

Suggested Reading:

1. Vasanth Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, 1997.
2. Prasanna Chandra, Projects-Planning, Analysis, Selection, Implementation and Review, Tata McGraw Hill Publishing Company Ltd., 1995.
3. Stephen R.Covey and Roger Merrill A., First Things First Simon, Schuster Publications, 1994.
4. Sudha (G.S.) Organizational Behaviour, National Publishing House, 1996.

SCHEME OF INSTRUCTION AND EXAMINATION

BE IV/IV YEAR (REGULAR)

(CIVIL ENGINEERING)

SEMESTER – II

S. No	Syllabus Ref. no.	Subject	Scheme of Instruction		Scheme of Examination		
			Periods per Week		Duration in Hours	Maximum Marks	
			L/T	D/P		Univ. Exam	Sessional
THEORY							
1	CE 451	Construction Management & Administration	4	-	3	75	25
2	CE 452	Disaster Mitigation and Management	4	-	3	75	25
3	CE	Elective II	4	-	3	75	25
4	CE	Elective III	4	-	3	75	25
PRACTICALS							
5	CE 481	Seminar	-	3	-	-	25
6	CE 482	Project	-	6	viva	Grade*	50
		Total	**16**	**9**		**300**	**175**

*Excellent / Very Good / Good / Satisfactory / Unsatisfactory (E / VG / G / S / US)

ELECTIVE – II

CE 453 Health Monitoring & Retrofitting of Structures
CE 454 Ground Improvement Techniques
CE 455 Advanced Environmental Engineering
CE 456 Advanced Reinforced Concrete Design
CE 457 Advanced Transportation Engineering

ELECTIVE – III

CE 458 Ground water Hydrology
CE 459 Finite Element methods
CE 460 Infrastructure Engineering
CS 403 Information Security
LA 454 Intellectual property Rights

CE 451

CONSTRUCTION MANAGEMENT AND ADMINISTRATION

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Significance of Construction Management: Objectives and functions of construction management, construction management team, principles of organization and types of organisation.

Unit-II

Construction Planning: Large scale production, economies of large scale production. Construction planning, bar charts, network techniques in construction management, CPM and PERT.

Unit-III

Time Cost Analysis: Cost time analysis in network planning, updating, simple problems of civil engineering works.

Time estimate: Expected likely, pessimistic and optimistic time, normal distribution curve and network problems.

Unit-IV

Contracts: Introduction, types of construction contracts and their advantages and disadvantages, conditions of contracts, safety in construction and safety measures, workmen compensation act, contract labour act. Demolition of buildings.

Tender: Tender form, Tender Documents, Tender Notice, Work Order.

Project Delivery Methods: BOT, SBOO, BOOT; Public Private Partnership (PPP), Detailed Project Report (DPR)

Unit-V

Optimization: Optimisation through linear programming, need for linear programming, linear programming model, graphical method, simplex method and linear programming in construction.

Suggested Reading:

1. Srinath L.s., PERT and CPM: *Principles and Application*, East-West Press, 1975.
2. Peret, F(2009), *Construction Project Management an Integrated approach*, Taylor and Francis, Taylor and Francies Group, London & New York.
3. Punmia B.C., and Khandelwal, *PERT and CPM*, Lakshmi Publications, 1990.
4. Gahloj. P.S. and Dhiv. B.M., *Construction Planning and Management*, Wiley Eastern Ltd., 1992.
5. Mahesh Varma, *Construction Planning and Equipment*, Metropolitan Book Co. Pvt. Ltd., 1985.

CE 452

DISASTER MITIGATION AND MANAGEMENT

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction – Natural, human induced and human made disasters – international decade of disaster reduction.

Unit-II

Natural Disasters – Hydrometereological based disasters – Trophical cyclones, floods, drought and desertification – Zones Geographical based disasters – Earth quake, Tsunammis, Landslides and avalanches.

Unit-III

Human induced hazards – chemical industrial hazards, major power breakdowns, traffic accidents, etc.

Unit-IV

Use of remote sensing and GISI disaster mitigation and management.

Unit-V

Rich and vulnerability to disaster – mitigation and management options – warning and forecasting.

Suggested Reading:

1. Rajib, S and Krishna Murthy, R.R.(2012) "*Disaster Management Global Challenges and Local Solutions"*, Universities Press, Hyderabad.
2. Navele, P & Raja, C.K. (2009), *Earth and Atmospheric Disasters Management*, Natural and Manmade, B.S. Publications, Hyderabad.
3. Fearn-Banks, K(2011), *Crises Computations Approach: A case book approach*, Route ledge Publishers, Special Indian Education, New York & London.
4. Battacharya, T. (2012), *Disaster Science and Management*, Tata McGraw Hill Company, New Delhi.

CE 481

SEMINAR

Instruction	3 Periods per week
Sessional	25 Marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his/her specialisation.

Seminar topics may be chosen by the student with advice from the faculty members. Students are to be exposed to the following aspects of a seminar presentation.

1. Literature survey
2. Organisation of the material
3. Presentation of OHP slides / PPT-presentation
4. Technical writing

Each student is required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PPT followed by a 10 minutes discussion.
3. Submit a report on the seminar topic with list of references and slides used.

Seminars are to be scheduled the 3rd week to the last week of the semester and any change in schedule should be discouraged.

For award of sessional marks students are to be judged by at least two faculty members on the basis of an oral and a written presentation as well as their involvement in the discussions.

CE 482

PROJECT

Instruction	6 Periods per week
Duration of University Examination	Viva
University Examination	Grade
Sessional	50 Marks

Solving a real life problem should be the focus of under graduate projects. Faculty members should prepare project briefs (giving scope and references) well in advance which should be made available to the students at the departmental library. The project may be classified as hardware / software / modeling / simulation. It may comprise any elements such as analysis, design, synthesis.

The department will appoint a project coordinator who will coordinate the following.

1. Grouping of students (a maximum of 3 in a group)
2. Allotment of projects and project guides
3. Project monitoring at regular intervals.

All projects allotments are to be completed by the 4th week of IV year 1st semester, so that students get sufficient time for completion of the project.

All projects will be monitored at least twice in a semester through students' presentation. Sessional marks should be based on the grades / marks, awarded by a monitoring committee of faculty members as also marks given by the supervisor.

Efforts be made that some of the projects are carried out in industries with the help of industry coordinators. Problems can also be invited from the industries to be worked out through undergraduate projects.

Common norms will be established for final documentation of the project report by the respective department.

- Excellent / Very Good / Good / Satisfactory / Unsatisfactory

ELECTIVE – II

CE-453

HEALTH MONITORING AND RETROFITTING OF STRUCTURES

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT–I

Introduction to Structural Health Monitoring (SHM) : Definition & motivation for SHM, SHM – a way for smart materials and structures, SHM and bio mimetic - analogy between the nervous system of a man and a structure with SHM, SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, Basic components of SHM, materials for Sensor design

UNIT–II

Application of SHM in Civil Engineering: Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post tensioned cables, monitoring historical buildings

UNIT–III

Non Destructive Testing of Concrete Structures : Introduction to NDT - Situations and contexts, where NDT is needed, classification of NDT procedures, Visual Inspection, Half- Cell Electrical Potential Methods, Schmidt Rebound Hammer Test, Resistivity Measurement, Electro Magnetic Methods, Radiographic Testing, Ultrasonic Testing, Infra Red Thermography, Ground penetrating Radar, Radio Isotope gauges, Other methods.

UNIT-IV

Condition Survey & NDE of Concrete Structure: Definition and objective of Condition Survey, Stages of Condition Survey (Preliminary, Planning, Inspection and Testing stages), possible defects in concrete structures, Quality control of concrete structures- Definition and need, Quality control applications in concrete structures, NDT as an option for Non- Destructive Evaluation (NDE) of Concrete structures, Case studies of a few NDT procedures on concrete structures

UNIT–V

Rehabilitation and Retrofitting Concrete Structures : Repair, rehabilitation & retrofitting of structures, damage assessment of concrete structures, materials and methods for repairs and rehabilitation, modelling of repaired composite structure, structural analysis and design – importance of re-analysis, execution of rehabilitation strategy, case studies

References:

1. Daniel Balageas, Claus-Peter FritzenamI Alfredo Guemes, *"Structural Health Monitoring"* published by ISTE Ltd, U.K. 2006.
2. *"Guide book on Non-destructive Testing of Concrete Structures, Training Course series no. 17"*, International Atomic Energy Agency, Vienna, 2002
3. *Hand book on "Repair and Rehabilitation of RCC Buildings"*, published by Director General, CPWD, Govt. of India, 2002.
4. *Hand book on Seismic Retrofitting of Buildings*, published by CPWD & Indian Building Congress in Association with IIT, Madras, Narosa Publishing House, 2008.

ELECTIVE – II

CE-454

GROUND IMPROVEMENT TECHNIQUES

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT–I

Introduction: Need for ground improvement, applications, factors affecting – different mechanical, chemical, static and dynamic technique – mechanical stabilization – blending of aggregate – Rothfunt's – Testing.

UNIT–II

Chemical Stabilization: Lime, cement, bitumen, factors influencing – Design approach, construction procedure, laboratory testing, additives. Suspension and solution grouts, principles, methods, equipment, applications, compaction grouting, jet grouting.

UNIT–III

Cohesionless Soils: In situ densification, vibro techniques – Mechanisms. Factors affecting, suitability number, compacting piles. Vibro replacement process.

UNIT-IV

Cohesive Soils: In situ densification, pre-loading – dewatering-sand drains. Sandwicks, geodrains, ropedrains, band drains-stone columns, lime piles – thermal and vacuum methods.

UNIT–V

Geotextiles: Woven and non-woven fabrics, types, functions and application – Geo-textiles, geo-grides test on geo-textiles. Reinforced earth principles and factors governing design.

References:

1. Hansmann, R., *"Engineering principles of Ground Modification",* McGraw Hill Publishing Co.
2. Moseley, M.P., *"Ground Improvement"*
3. Fang-Hsai – Yang, *"Foundation Engineering Hand Book"*, 2nd edition, CBS Publication, New Delhi.
4. Rao, G.V. and Raju, G.V.S.S., *Engineering with Geosynthesis.*

ELECTIVE – II

CE 455

ADVANCED ENVIRONMENTAL ENGINEERING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Industrial Waste Management: Types of industries, characteristics of industrial wastes, effects of industrial effluents on streams, land and human health. Environmental legislation related to industrial effluents and hazardous wastes. Self-purification of water bodies, streeter phelps equation.

UNIT-II

Industrial Waste Water Treatment: Manufacturing process, waste water characteristics and effluent of the following industries – Leather tanning, dairy, pulp and paper, pharmaceutical, textiles, steel plants, thermal power plants, fertilizer, cement, sugar and distilleries.

UNIT-III

Air Pollution: Sources, classification and effects of air pollutants, Meteorology of air pollution, wind rose diagrams, lapse rates, atmospheric stability and dispersion of air pollutants, stack height calculation, ambient air quality monitoring, stack sampling, analysis of air pollutants.

UNIT-IV

Air Pollution Control: Air quality standards, methods of air pollution control-zoning, source correction, control of suspended parciulate matter by equipment (gravitation, centrifugation, filtration, scrubbing, electrostatic precipitation), selection of proper equipment, gaseous pollutant control by absorption, condensation, combustion.

UNIT-V

Environmental Impact Assessment: Need for environmental impact assessment (EIA), objectives of EIA. EIA capabilities and limitations. Legal provisions of EIA. Methods of EIA, base line data collection required for EIA, evaluation of impacts, prediction of impacts. Preparation of Environmental Management Plan, preparation of EIAs of road project, Industry, and dam. Issues related to rehabilitation of affected people, Preparation of Environmental impact statement and Environment management plan.

Suggested Readings:

1. Rao M.N. and Dutt, *Waste Water Treatment*, Oxford and IBM Publications Ltd.,
2. Eckenfelder, *Industrial Waste Pollution Control*, McGraw Hill Book Co.
3. C.S.Rao, *Environmental Pollution Control Engineering*, WileyEastern Ltd., New Delhi.
4. M.N.Rao, H.V.N. Rao, *Air Pollution Control,* Tata McGraw Hill.
5. Peavy and Rowe, *Environmental Engineering,* McGraw Hill Publications.
6. Keiley, *Environmental Engineering,* McGraw Hill Publishers, 2003.
7. Sincero and Sincere, *Environmental Engineering,* Prentice Hall of India.

ELECTIVE – II

CE 456

ADVANCED REINFORCED CONCRETE DESIGN

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Beams curved in plan: Introduction - design principles - structural design of beams curved in plan of circular and rectangular types.

Deep beams: Introduction – flexural and shear stresses in deep beams. I.S. Code provisions – Design of deep beams.

UNIT-II

Building frames: Substitute frame method of analysis for building frames – design of rectangular portal frames for vertical loading including hinges at the base – Detailing of frames.

Flat slabs: Introduction, Components – I.S. Code provisions – Design methods, Design for flexture and shear – openings in flat slabs.

UNIT-III

Pile foundations: Structural design of piles and pile caps.

Raft Foundations: Definitions, Types - structural analysis and design of raft foundation for buildings with column grids up to three by two.

Suggested Readings:

1. N.Krishn Raju, *Advanced Reinforced Concrete Design*, CBS Publishers.
2. H.J. Shah, *Reinforced Concrete*, Charotar Publishers.
3. P.C.Varghese, *Advanced Reinforced Concrete Design*, PHI, 2001.
4. Dr. B.C.Punmia, et al, *Comprehensive R.C.C. Designs,* Laxmi Publishers, 1998.

ELECTIVE – II

CE 457

ADVANCED TRANSPORTATION ENGINEERING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Soil – Stabilized Road: Preliminary investigation, materials, techniques of stabilizations, methods of stabilization, Mechanical, Mehra's method, Soil-Cement, Soil bitumen and Soil Lime stabilization.

Unit-II

Flexible and Rigid Pavement Design: GI Method, IRC revised CBR, design of rigid pavement - concepts of ESWL, stresses due to Loads, temperature, warping, friction & critical combination, IRC method of Rigid pavement design.

Unit-III

Pavement Distress and Evaluation: Skid Resistance, structural evaluation, Benkelman beams method, overlays, highway drainage – Importance, requirements, surface drainage systems, sub-surface drainage system.

Unit-IV

Highway Capacity & Economic Evaluation: Concept of passenger car units (IRC), Level of service – concept, factors, multilane capacities for rural, urban and express ways, concept of transport cost & benefits, benefit cost ratio, net present value, rate of return and their relative comparison for evaluation. Accidents, causes, methodologies for accident causing precautions to minimize the accidents.

Unit-V

Travel Demand Management: Traffic Management Systems (TMS) – Restrictions on turning movements, One way streets, Tidal Flow – Operations, Exclusive Bus Lanes. Traffic Relief at junctions, Parking studies, parking inventories, types of parking service, parking analysis, bottle necks. Nature of traffic problems in cities. Effect on environment due to traffic noise and air pollution, introduction of Computer applications in traffic and transport planning.

Suggested Reading:

1. Kadiyali, L.R., *Principles and Practice of Highway Engineering*, Khanna Publications, New Delhi, 2000.
2. Sharma, S.K., Principles, *Practices and Design of Highway Engineering including Airport Pavements*, S.Chand and Company ltd, New Delhi, 2012.
3. Y.H.Huang, *Pavement Analysis and Design*, Prentice Hall, Englewood Cliffs, New Jersey, 2004.
4. Yoder, E.J.; Witczak, M.W., *Principles of pavement Design*, 2nd Edition, John Wiley and Sons, Indian Edition, New Delhi, 2012.
5. F.L.Mannering, W.P.Kilareski and S.S. Washburu, *Principles of Highway Engineering and Traffic Analysis*, John Wiley and Sons, 2005.

ELECTIVE – III

CE 458

GROUND WATER HYDROLOGY

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Introduction: Ground water in the hydrologic cycle, vertical distribution of ground water. Types of aquifers – unconfined, confined and leaky aquifers, porosity, void ratio, storage coefficient, permeability, transmissivity, specific yield, safe yield. General equation of ground water flow, steady undirectional flow, steady radial flow to a well in unconfined and confined aquifers. Steady flow with uniform recharge.

Unit-II

Unsteady Radial Flow to a well: Non equilibrium equation for pumping tests, Theis method of solution, Cooper Jacob method, Chow's methods of solution, law of times, well flow near acquifer boundaries. Image wells, multiple well systems, partially penetrating wells, steady radial flow in leaky artersion aquifer. Well completion and well development.

Unit-III

Geophysical Exploration: Surface investigations of ground water – Electrical Resistivity method, seismic refraction method, gravity and magnetic methods, geologic methods, Dowsing. Subsurface Investigations – Test Drilling, resistivity logging, potential logging, Temperature logging, caliper logging, Interpretation of logs and selection of site as a well.

Unit-IV

Artificial Recharge of Ground Water: Methods of recharge, water spreading, sewage discharge, Recharge through pits and shafts, Recharge through well, Induced recharge. Sea water intrusion in coastal aquifers; occurrence, Ghyben-Herzberg relation, space of fresh – salt water interface, length of the intruded sea water wedge, oceanic island aquifers, upcoming, prevention and control of sea water intrusion.

Unit-V

Ground Water Basin Management: Conjuctive use of surface and ground waters, Hydrologic balance equation. Ground water analog models-sand models, electric analog models, viscuous flow models, numerical analysis models – Finite difference method.

Suggested Reading:

1. D.K.Todd, *Ground Water Hydrology*, John Wiley & Sons, Inc., USA.
2. H.M.Ragunath, *Ground Water*, Wiley Eastern Limited, New Delhi.
3. K.P.Karnath, *Ground Water Ananment, Development and Management*, Tata McGraw Hill Publishing Company, New Delhi.
4. Walton, *Ground Evaluation and Management*, McGraw Hill.
5. Bouwer, *Ground Water Hydrology*, McGraw Hill.

ELECTIVE – III

CE 459

FINITE ELEMENT METHODS

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Introduction to the finite element method: Variational approach, Rayleigh – Ritz, and Galerkin's methods. Stiffness matrix for two noded bar, truss and beam elements, problems with 3 degrees of freedom.

UNIT –II

Stiffness matrix for two noded beam element with 3 degrees for freedom per node. Transformation, generation of stiffness matrix for frames. Strain displacement and stress-strain relationship in an elastic continuum (linear problems). Equations of equilibrium, and boundry conditions. Plane stress and plane strain problems.

UNIT- III

Formulation of finite element method using principle of virtual displacement. Determination of stiffness matrix for three noded triangular element (constant strain triangle) and 4 noded rectangular element for plane stress and plane strain problems. Convergence criteria for selection of displacement models. Discrimination of continuum. Assembly of global stiffness and load matrices. Displacement boundary conditions.

UNIT- IV

Isoparametric finite elements: Direct construction of shape functions for higher order elements using natural co-ordinate system. Shape functions for eight noded parabolic curved isoparametric element. Determination of element stiffness matrix for four noded quadrantal element. Use of Jacobian and Gauss quadrature techniques. Load matrix for eight noded rectangular isoparametric element (for body forces and surface traction)

UNIT - V

Strain displacement and stress-strain for axisymmetric problems. Stiffness matrix for three noded ring element. Volume co-ordinates and stiffness matrix for four noded tetrahedron element.

Suggested Reading:

1. O.C. Zienkiewicz and R.L.Taylor, *The Finite Element Method*, Vol. I, McGraw Hill, 1989.
2. C.S. Krishna Moorthy, *Finite Element Analysis*, McGraw Hill, 1991.
3. C.S. Desai and J.F. Abel, *Introduction to the Finite Method*, Van Nostrand, 2002
4. T.R. Chandrupatla, *Finite Element Analysis for Engineering and Technology*, Universities Press, 2004

ELECTIVE – III

CE 460

INFRASTRUCTURE ENGINEERING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

An overview of Infrastructure Engineering: Urban infrastructure and rural infrastructure in general. An introduction to special economic zones, organizations and players in the field of infrastructure, the stages in an infrastructure project, concept of lifecycle., etc., An overview of infrastructure projects in power sector, water supply and sanitation sector, road, rail, air and port transportation sectors and telecommunications.

UNIT –II

Public & Private Sector Role in Infrastructure Development: A historical overview of infrastructure privatization. The benefits of infrastructure privatization, problems with infrastructure privatization, challenges in privatization water supply, power, infrastructure, road transportation infrastructure in India – case studies preferable.

UNIT- III

Infrastructure Planning and Implementation: Mapping and facing the landscape of risks in infrastructure projects, core economic and demand risks, political risks, socio-environmental risks, cultural risks in international infrastructure projects, legal and contractual issues in infrastructure, challenges in construction and maintenance of infrastructure – case studies preferable.

UNIT- IV

Environmental and Social Impact Assessment aspects: Categories, attributes and parameters, identification of environmental and social impacts over project area and over project cycle. Special considerations involving land and water interrelationships-enviornmental laws and regulations, introduction to B-O-T, BOOT projects & PPP projects.

UNIT - V

Stategies for successful infrastructure project implementation: Risk management framework for infrastructure projects, shaping the planning phase of infrastructure projects. Government role in infrastructure implementation, an integrated framework for successful infrastructure planning and management – infrastructure management systems and future directions.

Suggested Reading:

1. Grigg, Neil, *Infrastructure Engineering and Management*, Wiley, 1988.
2. Haas and Hudson, Zaniewski, *Modern Pavement Management*, Krieger, Malabar, 1994.
3. Hudson, Hass, Uddin, *Infrastructure management: integrating design, construction, maintenance, rehabilitation and renovation*, McGraw Hill, 1997.
4. Munnell, Alicia, Editor, *Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June (1990).*
5. World Development Report 1994: *Infrastructure for Development, 1994.*
6. Zimmerman, K. and F. Botelho, *Pavement management Trends in the United States*, 1st European Pavement Management Systems Conference, Budapest, September 2000.
7. Anjaneyulu, Y & Manickam, V, *Environmental Impact Assessment Methodology*, B.S. Publications, Hyderabad.
8. NPTEL – Course Material prepared by IIT Madras

ELECTIVE – II

CS 403

INFORMATION SECURITY

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction: History, critical characteristics of information, NSTISSC security model, components of an information system, securing the components, balancing security and access, the SDLC, the security SDLC.

Need for Security: Business needs, treats, attacks-secure software development.

Unit-II

Legal, Ethical and Professional Issues: Law and ethics in information security, relevant U.S. laws-international laws and legal bodies, ethics and information security.

Risk Management: Overview, risk identification, risk assessment, risk control strategies, selecting a risk control strategy, quantitative versus qualitative risk control practices, risk management discussion points, recommended risk control practices.

Unit-III

Planning of Security: Security policy, standards and practices, security blue print, security education, continuity strategies.

Security Technology: Firewalls and VPNs: Physical design, firewalls, protecting remote connections.

Unit-IV

Security Technology: Intrusion detection, access control and other security tools: intrusion detection and prevention systems, scanning and analysis tools, access control devices.

Cryptography: Foundations of cryptology, cipher methods, cryptographic algorithms, cryptographic tools, protocols for secure communications, attacks on cryptosystems. .

Unit-V

Implementing Information Security: Information security project management, technical topics of implementation, non-technical aspects of implementation, security certification and accreditation.

Security and personnel: Positioning and staffing security function, employment policies and practices, internal control strategies.

Information security maintenance: Security management models. The maintenance model, digital forensics.

Suggested Reading:

1. Michael E. Whitman and Hebert J Mattord, *Principles of Information Security*, 4th edition, Ed. Cengage learning 2011.
2. Thomas R Peltier, Justing Peltier, John Blackley, *Information Security, Fundamentals*, Auerbacj publications, 2010.
3. Detmar W Straub, Seymor Goodman, Richard L Baskerville, *Information Security, Policy processes and practices*, PHI 2008.
4. Marks Merkow and Jim Breithaupt, *Information Security, Principle and practices*, Pearson Education 2007.

ELECTIVE – II

LA 454

INTELLECTUAL PROPERTY RIGHTS

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction: Meaning of Intellectual property, nature of I.P., projection of I.P, rights, kinds of Intellectual Property Rights, international conventions of Intellectual Property Rights, patent treaty 1970, GATT 1994, TRIPS & TRIMS. International Organization for Protection of IPR – WTO, WIPO, UNESCO.

Unit-II

Patents: Meaning of patent, commercial significance, obtaining of patent, patentable subject, matter-rights and obligations of patentee, specification, registration of patents, compulsory licensing and licenses of rights, revocation.

Unit-III

Industiral Designs: Definition of designs, registration of designs, rights and duties of proprietor of design. Piracy of registered designs.

Unit-IV

Trademarks: Meaning of trademark, purpose of protecting trademarks registered trademark, procedure – passing off. Assignment and licensing of trademarks, infringement of trademarks.

Unit-V

Copy Rights: Nature, scope of copyright, subject matter of copyright, right conferred by copyright, publications. Broadcasting, telecasting, computer program, database right. Assignment, transmission of copyright, infringement of copyright.

Suggested Reading:

1. Cornish W.R., *Intellectual Property – Patents, Copyright, Trademarks and Allied Rights*, Sweet & Maxwell, 1993.
2. P.Narayanan, *Intellectual Property Law*, Eastern Law House, 2/c, 1997.
3. Robin Jacob & Danial Alexander, *A Guide book to Intellectual Property Patents*, Sweet and Maxwell, 4/c, 1993.
4. Ganguly, *Intellectual Property: Unleashing the Knowledge Economy*, TMH, 2003.