

**CENTRAL UNIVERSITY OF HARYANA
MAHENDARGARH**

**SCHEME OF STUDIES & EXAMINATIONS
B. Tech. in CIVIL ENGINEERING**

**Choice Based Credit System
(w.e.f. Session 2021-22)**

Central University of Haryana
Department of Civil Engineering
B. Tech. 4th YEAR (SEMESTER – VII)
Scheme of Studies and Examinations

| S. No. | Course No. | Course Title | Teaching Schedule | | | Credits |
|--------------|------------|--------------------------------------|-------------------|----------|-----------|-----------|
| | | | L | T | P | |
| 1 | BTCE 701A | DESIGN OF HYDRAULIC STRUCTURES | 3 | - | - | 3 |
| 2 | BT CE 702A | MINOR PROJECT | - | - | 8 | 4 |
| 3 | BT CE 703A | SUMMER INTERNSHIP | - | - | 2 | 1 |
| 4 | BT CE 704A | GENERAL FITNESS IN CIVIL ENGINEERING | - | - | 2 | 0 |
| 5 | BT MGT 705 | ENTREPRENEURSHIP | 3 | - | - | 3 |
| 6 | DCEC– III | | 3 | - | - | 3 |
| 7 | DCEC – IV | | 3 | - | - | 3 |
| 8 | GEC – III | | 3 | 1 | - | 4 |
| Total | | | 15 | 1 | 12 | 21 |

L = Lecture, T = Tutorial, P = Practical, & C = Credits

List of Departmental Core Elective Course (DCEC III)

| S. No. | Code | Subject |
|--------|-------------|----------------------------------|
| 1 | BT CE -721A | EARTHQUAKE ENGINEERING |
| 2 | BT CE -722A | DESIGN OF CONCRETE STRUCTURES-II |
| 3 | BT CE-723A | DESIGN OF STEEL STRUCTURES-II |
| 4 | BT CE-724A | BRIDGE ENGINEERING |

List of Departmental Core Elective Course (DCEC IV)

| S. No. | Code | Subject |
|--------|------------|--|
| 1 | BT CE-725A | GROUND IMPROVEMENT TECHNIQUES |
| 2 | BT CE-726A | GEOTECHNICAL EXPLORATION AND INSTRUMENTATION |
| 3 | BT CE-727A | DESIGN WITH GEOSYNTHETICS |
| 4 | BT CE-728A | ENVIRONMENTAL GEOTECHNOLOGY |

Note

- Students will be permitted to opt for any one elective run by the other department. The choice of the students to choose any elective from any other department of university, those are offering electives for UG course.
- Students will be permitted to opt for any two program elective (one from each basket) run by the department (DCEC). The minimum strength of the students should be 20 to run an elective
- Assessment of Summer Internship, undergone at the end of VI semester, will be based on seminar, viva-voce, report and certificate of Summer Internship obtained by the student from the industry, institute, research lab, training center etc
- The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
- Electronics gadgets including Cellular phones are not allowed in the examination

Central University of Haryana
Department of Civil Engineering
B. Tech. 4th YEAR (SEMESTER – VIII)
Scheme of Studies and Examinations

| S. No. | Course Code | Course Title | Teaching Schedule | | | Credits |
|--------------|-------------|-----------------------------------|-------------------|----------|-----------|-----------|
| | | | L | T | P | |
| 1 | BTCE 801A | MAJOR PROJECT/INDUSTRY INTERNSHIP | - | - | 20 | 10 |
| 2 | BT CE 802A | DISASTER MANAGEMENT | 3 | - | - | 3 |
| 3 | DCEC – V | | 3 | - | - | 3 |
| 4 | GEC – IV | | 3 | 1 | - | 4 |
| Total | | | 9 | 1 | 20 | 20 |

L = Lecture, T = Tutorial, P = Practical, & C = Credits

List of Departmental Core Elective Courses (DCEC V)

| S. No. | Code | Subject |
|--------|-------------|------------------------------------|
| 1 | BT CE -821A | PAVEMENT EVALUATION AND MANAGEMENT |
| 2 | BT CE -822A | AIRPORT PLANNING AND DESIGN |
| 3 | BT CE-823A | GROUND WATER ENGINEERING |
| 4 | BT CE-824A | WATERSHED MANAGEMENT |

List of General Elective Course (GEC) offered by the department

| S. No. | Code | Subject |
|--------|-------------|-----------------------------------|
| 1 | BT CE -731A | ELEMENT OF EARTHQUAKE ENGINEERING |
| 2 | BT CE -732A | ROAD SAFETY AUDIT |
| 3 | BT CE -831A | DISASTER MANAGEMENT |
| 4 | BT CE -832A | WATERSHED MANAGEMENT |

Note:

1. Students are required to choose one group from Group A & Group B.
 - a. In Group A students will attend all the classes regularly and do one project related to research work and they need to publish one paper in conference.
 - b. In Group B students will move into the industry and do their live project in industry. They would be required to submit certificate and submit project report on completion of their industrial internship. They will complete all other subjects in online mode/ they can choose subjects from MOOC/ NPTEL/SWAYAM.
2. Students will be permitted to opt for any one elective run by the other department. The choice of the students to choose any elective from any other department of university, those are offering electives for UG course.
3. Students will be permitted to opt for any one program elective run by the department (DCEC). The minimum strength of the students should be 20 to run an elective
4. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
5. Electronics gadgets including Cellular phones are not allowed in the examination

BT CE-701A: DESIGN OF HYDRAULIC STRUCTURES

B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|---|----|----|--------|
| 3 | -- | -- | 3 |

Course Outcomes

- CO1: Students will acquire knowledge for the design of hydraulic structures like diversion headworks
- CO2: To get knowledge about cross drainage works and design of syphon aqueduct
- CO3: To get knowledge about Regulation works and design of fall structures
- CO4: Students will develop knowledge for the design of dams including failures like gravity dam, earth dam & Arch Dam.
- CO5: Student will assimilate the knowledge on various types of spillways and their design

UNIT - I

Diversion canal Headworks:

Various components and their functions, layout plan, selection of site for diversion headworks, Bligh's creep theory, Khosla's method of independent variables, use of Khosla's curves, various corrections, silt excluders.

Cross drainage works:

Classification and their selection, hydraulic design aspects of aqueducts, syphon aqueducts, super passage, canal syphon and level crossing, design of transitions.

UNIT - II

Regulation works: Canal falls-necessity and location, development of falls, design of cistern element, roughening devices, design of Sarda type fall, and design of straight Glacis fall. Off-take alignment, cross-regulator and distributory, head regulators, devices to control silt entry into the off-taking channel and silt ejector, canal escapes, types of escapes

UNIT - III

Storage Headworks: Types of dams, selection of a site, gravity dam-two dimensional design, forces acting, stability criterion, elementary profile of a dam, cutoffs and drainage galleries, arch dams-constant angle and constant radius arch dam, simple design and sketches, most economical angle, Earth dam, design principles, seepage through earth dams, seepage line, control of seepage, design of filters.

UNIT - IV

Spillways and Energy Dissipaters: Essential requirements of spillway and spillway's capacity, types of spillways and their suitability, Ogee spillways, chute, side channel, shaft and syphon spillways, energy dissipation below spillways, stilling basins, USBR and I.S. Stilling Basins.

Suggested Readings

1. Garg, S.K., *Irrigation Engg & Hydraulic Structures*, Khanna Publisher, 2013

2. *Guidelines for Lining of Irrigation Canals*, Govt. of Odissa, Water Resources Department, 2019
3. Modi, P.N., *Irrigation, Water Resources and Water Power Engg*, Standard Book House, 2014
4. Ojha, C. S. P., *Engineering Hydrology*, Oxford University Press, 2017
5. Punmia, B. C. and Pande, *Irrigation, and water power Engineering*, Standard Publisher, 2016
6. Sharma, S.K., *Irrigation Engg*, S.Chand Publishers, 2017
7. Singh, Bharat, *Fundamentals on Irrigation Engg.*, 6th Edition, Nem Chand & Bros, 1979
8. Subramanyam, K., *Engineering hydrology*, Tata McGraw Hill, 2013

Note: Latest Edition of Books is to be taken.

BT CE 702A: MINOR PROJECT

B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|----------|----------|----------|---------------|
| -- | -- | 8 | 4 |

The project started in VII Semester will be continued in VIII Semester and will be evaluated through a panel of examiners consisting of the following:

| | |
|----------------------------|-----------------------------------|
| Chairperson of Department: | Chairperson |
| Project coordinator: | Member |
| External expert: | To be appointed by the University |

The student will be required to submit two copies of his/her project report to the department for record (one copy each for the department and participating teacher).

Project coordinator will be assigned the project load of, maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

The format of the cover page and the organization of the body of the report for all the B. Tech. will be finalized and circulated by the Project coordinator.

BT CE- 703A SUMMER INTERNSHIP

B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|----------|----------|----------|---------------|
| -- | -- | 2 | 1 |

At the end of VI semester each student would undergo four weeks Industrial/ Summer Internship in an Industry/ Institute/ Professional Organization/ Research Laboratory etc. with the prior approval of the university and submit in the department a typed report along with a certificate from the organization.

The typed report should be in a prescribed format. The report will be evaluated in the VII Semester by a Committee consisting of teachers from different specialization to be constituted by the Chairperson of the department. The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization.

The internal marks distributions for the students who have undergone Summer Internship consist of 30 marks by the committee members consisting of faculty members of concerned department and 70 marks by the external examiner.

The student will interact with the committee through presentation to demonstrate his/her learning.

Teachers associated with evaluation work will be assigned 2 periods per week load.

BT CE-704A GENERAL FITNESS IN CIVIL ENGINEERING

B. Tech. 4thYear (Semester – VII)

| L | T | P | Credit |
|----|----|---|--------|
| -- | -- | 2 | 0 |

The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life. The evaluation will be made by the committee of examiners constituted as under:

- | | |
|----------------------------------|-----------------------------|
| 1. Dean/ Head of Department | Chairperson |
| 2. Coordinator of the department | Member |
| 3. External expert | Appointed by the university |

A. The student will present a written report before the committee with following in view: The student will present before the committee his/her achievements during the current academic session in the form of a written report highlighting followings:

- | | |
|--|------------|
| I. Academic Performance | (10 Marks) |
| II. Extra Curricular Activities / Community Service, Hostel Activities | (10 Marks) |
| III. Technical Activities / Industrial, Educational tour | (10 Marks) |
| IV. Sports/games | (10 Marks) |

Note: Report submitted by the students should be typed on both sides of the paper.

B. A student will support his/her achievement and verbal & communicative skill through presentation before the examiners. (30 Marks)

C. Faculty Counselor Assignment (30 Marks)

It will be the duty of the student to get evaluated by respective faculty counselor. A counselor will assess the student which reflects his/her learning graph including followings:

1. Discipline throughout the year
2. Sincerity towards study
3. How quickly the student assimilates professional value system etc.
4. Moral values & Ethics- Syllabus (one lecture/week on the topics of Human values/Ethics is to be delivered)

Note: Faculty Counselor should be in regular contact to the students throughout the year.

BT MGT – 705A: ENTREPRENEURSHIP

B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|---|----|----|--------|
| 3 | -- | -- | 3 |

Course Outcome

- CO1: Understand the concept of Entrepreneurship and Entrepreneurial Culture
- CO2: Learn to create Entrepreneurial Venture
- CO3: Learn the various government schemes of Entrepreneurship Development
- CO4: Understand the theory of project management and case studies

UNIT – I

Entrepreneur & Entrepreneurship: Introduction; Evolution to the Concept of Entrepreneur; Role of Entrepreneurship in Economic development; Characteristics of successful Entrepreneurs; Need for an Entrepreneur; Functions of Entrepreneur; Types of Entrepreneurs – Women, Rural, Tourism, Agri-Preneurship and Social Entrepreneurship; Entrepreneur Vs a Manager; Entrepreneurial decision process; Factors affecting Entrepreneurship growth.

UNIT – II

Entrepreneurial Motivation: Meaning, motivating factors, Theories of Entrepreneurial motivation; Entrepreneurial Motivational Behaviour's motives: Creativity, Self efficacy, Locus of Control, Risk taking, Leadership, Communication; Entrepreneurial Competencies: Meaning, Major Entrepreneurial Competencies; International Entrepreneurship – Opportunities and challenges; Forms of Business Ownerships.

UNIT – III

Business Start ups: Introduction, characteristics and types; Micro and Small Enterprises: meaning, importance, features and characteristics, Rationale behind micro and small enterprises, Scope of Micro and Small Enterprises; Entrepreneurship Project Development: Idea generation –sources & techniques, Identifying Opportunity, Business Plan Formulation, Project Appraisal, Developing a Marketing Plan, Business Plan Failures.

UNIT – IV

Government Support to new enterprises: Entrepreneurship Development Programmes (EDPs), Role of Central and State Government in promoting Entrepreneurship, Financing of an Enterprise, Agencies for Marketing Support, Agencies for Consulting, Training and other Support, Taxation benefits to small scale enterprises, MSME policy in India.

Suggested Readings

1. Dutta, B. (2009). *Entrepreneurship Management (Text and Cases)* (1 ed.). New Delhi: Excel Book, 2009

2. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2017). *Entrepreneurship*. (10 ed.). Chennai: McGraw Hill Education (India) Private Limited, 2017
3. Khanka, S.S. (2016). *Entrepreneurial Development* (4 ed.). New Delhi: S. Chand & Company Ltd, 2016.
4. Scarborough, N.M., & Cornwall, J.R. (2014). *Essentials of Entrepreneurship and Small Business Management*. (8 ed.). New Delhi: Prentice Hall, 2014.

Note: Latest Edition of Books is to be taken.

ELECTIVE I
BT CE-721A: EARTHQUAKE ENGINEERING
B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|----------|-----------|-----------|---------------|
| 3 | -- | -- | 3 |

Course Outcomes

CO1. Acquire knowledge of engineering seismology

CO2. Analyze the earth quake forces and response of SDOF and MDOF system

CO3. Learn the design philosophies of earthquake resistant structures using IS codes 1893:2002

CO4. Evaluate the condition of the existing RC and masonry buildings.

UNIT –I

Engineering Seismology: Engineering seismology, Seismic zones of India, Earthquake and its causes, Types of waves, location of earthquakes, seismograph, Impact of Earthquake.

UNIT-II

Theory of Vibration: Free Body Diagrams, Undamped single degree of freedom systems, Damped single degree of freedom system, Response to single degree of freedom system to harmonic loads.

UNIT –III

Earthquake Resistant Design: Philosophy of Earthquake resistant Design, Design Consideration, Construction Details, Architectural General guidelines for Masonry buildings, RC buildings and non structural elements.

Earthquake Forces: Seismic coefficient and response spectrum method of analysis as per IS 1893 Codal Provisions. Examples on seismic force calculation of buildings.

UNIT – IV

Ductility Provisions: Introduction, ductility, ductility consideration for RC beams, RC Columns, Lateral reinforcement in columns, special reinforcement in columns, and ductility consideration for Beam column joints.

Seismic Vulnerability Assessment: Seismic evaluation of building, Rapid visual Inspection simplified and detailed vulnerability assessment, Detailed In-situ investigation, Non-destructive test, Partially destructive test.

Suggested Readings

1. Agarwal, Pankaj, *Earthquake Resistant Design of Structures*, PHI learning Private Limited, 2011
2. Aggrawal, M. M., *Railway Engineering Second Edition.*, Oxford Publication, 2013.
3. Chopra, Anil Kr., *Structural Dynamics*, Pearson, 2007
4. Clough and Penzian, *Dynamics of Structures*, McGraw Hill Publishing Co., New York, 1993
5. Paz, Mario, *Structural Dynamics (Theory and Computation)*, CBS Publishers and Distributors, 2004

6. Roy, R. Carig, Jr., *Structural Dynamics (An Introduction to computer methods)*, John Wiley & Sons

Note: Latest Edition of Books is to be taken.

ELECTIVE II
BT CE-722A: DESIGN OF CONCRETE STRUCTURES II

B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|----------|-----------|-----------|---------------|
| 3 | -- | -- | 3 |

Course Outcomes

- CO1. Understand the concept and design of Flat slab and staircases
- CO2. Design of water tanks by using IS code
- CO3. Apply the IS code for the analysis and design of bunker and silos
- CO4. Learn to analyze yield line theory concept for slabs

UNIT –I

Flat slabs and Staircases: Advantages of flat slabs, general design considerations, approximate direct design method, design of flat slabs, openings in flat slab, design of various types of staircases, design examples.

UNIT-II

Water Tanks: Design requirements, rectangular and cylindrical underground and overhead tanks, Intze tanks, design considerations, design examples.

UNIT –III

Silos and Bunkers: Various theories, Bunkers with sloping bottoms and with high sidewalls, battery of bunkers, design examples.

UNIT – IV

Yield Line Theory: Basic assumptions, Methods of analysis, yield line patterns and failure mechanisms, analysis of one way and two way rectangular and non-rectangular slabs, effect of top corner steel in square slabs, design examples.

Suggested Readings

1. Ferguson, *Reinforced Concrete Fundamentals* Keith, Revised Edition, John Wiley and Sons, 1981
2. Gambhir, M.L., *Reinforced Concrete Design*, Macmillan India Ltd., New Delhi
3. Jain P., and Krishna, J., *Plain and Reinforced concrete, Vol. 2*, Nem Chand and Bros., Roorkee
4. Syal I.C., and Ummat, Behaviour, *Analysis and Design of R.C.C. Structural Elements*, A.H. Wheelers, New Delhi
5. Varghese, P. C., *Advanced Reinforced Concrete Structures*, Tata McGraw Hill
6. Varghese, P. C., *Reinforced Concrete Structures*, Tata McGraw Hill

Note: Latest Edition of Books is to be taken.

ELECTIVE III

BT CE-723A: DESIGN OF STEEL STRUCTURES II

B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|---|----|----|--------|
| 3 | -- | -- | 3 |

Course Outcomes

- CO1. Analyze the necessity of construction of railway track, its components and properties
- CO2. Understand the geometrics of railway alignment and concepts associated to them
- CO3. Understand the importance of airport planning and site selection for all types of airports
- CO4. Design the runway and taxiway and understand the necessity of others airport amenities

UNIT –I

Elementary Plastic Analysis and Design: Introduction, Scope of plastic analysis, ultimate load carrying capacity of tension members and compression members, flexural members, shape factor, mechanisms, plastic collapse, plastic analysis and design of simple portal frames.

UNIT-II

Design of Steel Stacks: Introduction, various loads to be considered for the design of steel stacks, design of steel stacks including foundation.

Cold formed Sections: Introduction and brief description of various types of cold formed sections

UNIT –III

Towers: Transmission line towers, microwave towers, Design loads, classification, design procedure and specification

Water Tank: Analysis and Design of Water Tank

UNIT – IV

Industrial Buildings: Loads, general arrangement and stability, design considerations, design of purlins, design of roof trusses, industrial building frames, bracings.

Suggested Readings

1. Arya A.S., and Ajmani, J.L., *Design of Steel Structures*, Nem Chand Brothers, Roorkee
2. BIS Codes IS 800:2007, IS 801:1975, IS 875
3. Chandra, Ram, *Design of Steel Structures, Vol. I & II*, Standard Book House
4. Dayaratnam, P., *Design of Steel Structures*, Wheeler Publishing, New Delhi.
5. Gaylord and Gaylord, *Design of Steel Structures*, Mcgraw hill Publication, New York

Note: Latest Edition of Books is to be taken.

ELECTIVE IV
BT CE-724A: BRIDGE ENGINEERING
B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|----------|-----------|-----------|---------------|
| 3 | -- | -- | 3 |

Course Outcomes

CO1: Learn about the general consideration and IRC codes related to Bridge Engineering

CO2: To impart knowledge for analysis and design of various types of bridges

CO3: Analyze the box culverts for the given loading and detail the box culverts

CO4: Development of Bridge substructure and different type of foundation, Bearing and Joints:
Various types of expansion bearing and fixed bearings, elastomeric bearings, joints and their types.

UNIT-I

General Consideration: Site selection, various types of bridges and their suitability, loads, forces and IRC bridge loading and permissible stresses, Economic Spans.

UNIT-II

Design of RC bridges under concentrated loads using effective width and Pigeauds Method, Courbon's method of load distribution.

. UNIT-III

Detail design of T-beam bridge slab culvert and box culverts

. UNIT-IV

Bridge substructure and bearings, Design of piers and pier caps. Abutments, Different types of foundations, used for design of substructure.

Suggested Readings

1. Ponnuswamy, S., *Bridge Engineering*, Tata McGraw Hill
2. Raina, V. K., *Concrete Bridge Practice*, Tata McGraw Hill
3. Raju, N. K., *Design of Bridges*, Oxford & IBH
4. Victor, D. J., *Essentials of Bridge Engineering*, Oxford & IBH

Note: Latest Edition of Books is to be taken

ELECTIVE V

BT CE 725A: GROUND IMPROVEMENT TECHNIQUES

B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|---|----|----|--------|
| 3 | -- | -- | 3 |

Course Outcomes

On completion of the course, student would be able to:

CO1. Identify the need and importance of ground improvement.

CO2. Determine different techniques to stabilize cohesionless and cohesive soils.

CO3. Improve the characteristics of the soil by using different techniques.

CO4. Apply the concept of soil reinforcement to enhance the soil in different areas of Civil Engineering.

UNIT –I

Introduction to ground improvement, need for ground improvement, classification of ground modification techniques, ground improvement potential, emerging trends in ground improvement.

General Principal of Compaction: Mechanics, field procedure, quality control in field.

UNIT-II

Ground Improvement in Granular Soil: In place densification by (i) Vibroflotation (ii) Compaction pile (iii) Vibro-Compaction (iv) Dynamic Compaction (v) Blasting.

Ground Improvement in Cohesive Soil: Compressibility, vertical and radial consolidation, preloading methods. Types of drains, vertical drains, construction techniques.

UNIT –III

Stone Column: Function, design principles, load carrying capacity, construction techniques.

Ground Improvement by Grouting: Grouting in soil, types of grout, desirable characteristics, grouting pressure, grouting methods.

Soil Stabilization: Lime Stabilization-Base exchange mechanism, Pozzolanic reaction, lime-soil interaction, lime columns. Cement stabilization: Mechanism, amount, age and curing. Fly-ash - Lime Stabilization, Soil Bitumen Stabilization.

UNIT – IV

Soil Reinforcement: Mechanism, Types of reinforcing elements, reinforcement-soil interaction, Reinforcement of soil beneath the roads, foundations.

Geosynthetics, types of geosynthetics, functions of geosynthetics and their applications.

Suggested Readings

1. Das, B. M., *Principles of Foundation Engineering*, Cengage Learning, 2011.
2. Koerner, R. M., *Designing with Geosynthetics, Vol. 1 & 2.*, Xlibris Corporation. 2012.
3. Manfred. R. Hausmann, *Engineering Principles of Ground Modification*, McGraw Hill, 1989
4. Moseley, M. P., Kirsch, K., *Ground Improvement*, Spon Press, 2004.

5. Murthy, V.N.S., *A text book on Soil Mechanics and Foundation Engineering.*, CBS Publishers & Distributors, 2018.
6. Purushothamaraj, P., *Ground Improvement Techniques*, University Science Press, 2005

Note: Latest Edition of Books is to be taken.

ELECTIVE VI

BT CE 726A: GEOTECHNICAL EXPLORATION AND INSTRUMENTATION

B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|---|----|----|--------|
| 3 | -- | -- | 3 |

Course Outcomes

- CO1. Identify relevant instrumentation required for characterizing the soil and rock with interdisciplinary approach.
- CO2. Interpret field and laboratory data and prepare soil investigation report.
- CO3. Prepare bore logs for different soil strata.
- CO4. Implement various exploration methods in soil and rock.

UNIT –I

Introduction: Soil Formation, types of soils, physical and biological weathering, soil transport, deposition and stratification phenomena and Soil Classification.

Soil Exploration: Soil Exploration Programme for different Civil Engineering Projects.

UNIT-II

Exploration Methods: Methods of Boring, Auguring and Drilling. Machinery used for drilling, types of augers and their usage for various projects.

Soil Sampling: sampling methods, types of samples, storage of samples and their transport. Sample preparation, sample sizes, types of samplers and specifications for testing.

UNIT –III

Borehole Logging: Logging of Boreholes-logging methods, Ground water observations, water table fluctuations and effects, Preparation of soil profiles, calculations

Field testing of soils: methods and specifications – visual identification tests, vane shear test, penetration tests, analysis of test results.

UNIT – IV

Report writing: Soil exploration Reports- identification, calculations and preparation.

Field Instrumentation: Rollers, Pressure meters, Piezometer, Pressure cells, Sensors, Inclinometers, Strain gauges etc.

Suggested Readings

1. Bowles, J. E., *Foundation Analysis and Design*, McGraw Hill Companies, 1997.
2. Desai, M. D., *Ground Property Characterization from In-Situ Testing*, IGS-Surat Chapter, 2005.
3. Hvorslev, M. J., *Sub-Surface Exploration and Sampling of Soils for Civil Engineering Purposes*, US Waterways Experiment Station, Vicksburg, 1949.
4. Moseley, M. P., Kirsch, K. *Ground Improvement*, Spon Press, 2004.
5. Ranjan, G., and Rao, A. S. R., *Basic and Applied Soil Mechanics*, New Age international Publishers.

Note: Latest edition of books is to be referred.

ELECTIVE VII
BT CE-727A: DESIGN WITH GEOSYNTHETICS
B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|----------|-----------|-----------|---------------|
| 3 | -- | -- | 3 |

Course Outcomes

- CO1. Select different type geosynthetics for intended purpose.
- CO2. Evaluate properties of geosynthetics.
- CO3. Design with geosynthetics in various civil engineering applications.
- CO4. Apply geocomposite systems to solve contemporary geotechnical problems.

UNIT –I

Introduction: An overview on the development and applications various geosynthetics -the geotextiles, geogrids, geonets, geomembranes and geocomposites.

UNIT-II

Designing with geotextiles: Geotextile properties and test methods – functions, Designing for separation, reinforcement, stabilization, filtration, drainage.

Designing with geogrids: Geogrid properties and test methods – physical properties, mechanical properties, endurance properties and environmental properties, Designing for grid reinforcement and bearing capacity.

UNIT –III

Designing with geonets: Geonet properties and test methods – Physical properties, mechanical properties, hydraulic properties, endurance properties and environmental properties -Designing geonet for drainage.

Designing with geomembranes: Geomembrane properties and test methods – physical properties, mechanical properties, chemical properties and biological hazard -Applications of geomembranes.

UNIT – IV

Designing with geocomposites: Geocomposites in separation, reinforcement – reinforced geotextile composites – reinforced geomembrane composites – reinforced soil composites using discontinuous fibres and meshes, geocomposites in drainage and filtration.

Suggested Readings:

1. G. L. Sivakumar Babu, *An Introduction to Soil Reinforcement and Geosynthetics*, University Press, 2005.
2. G. V. Rao, *Geosynthetics – An Introduction*, Sai Master Geoenvironmental Services Pvt. Ltd. Hyderabad, 2011.
3. R. M. Koerner, *Designing with geosynthetics*, Pearson Education Inc., 2005.
4. Shukla, *Fundamentals of Geosynthetic Engg.* Imperial College Press, London, 2006.

Note: Latest edition of books is to be referred.

ELECTIVE VIII

BT CE-728A: ENVIRONMENTAL GEOTECHNOLOGY

B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|---|----|----|--------|
| 3 | -- | -- | 3 |

Course Outcomes

- CO1. Identify soil and ground water contaminants.
- CO2. Select suitable remediation methods based on contamination.
- CO3. Apply concept of geosynthetics in design of landfills.
- CO4. Prepare the suitable disposal system for particular waste.

UNIT –I

Soil and ground water pollutants - their sources, nature, composition and polluting effects. The physico-chemical aspects of soils contaminated by various pollutants. Effects of environment and wastes on the properties of soils.

UNIT-II

Site characterization, Landfill Components and functions , Compacted clay liner, selection of soil, methodology of construction, Geosynthetics in landfill- types and functions, geosynthetic clay liners - Leachate and Gas Management.

UNIT –III

Engineering Properties of Waste materials and their geotechnical reuse: coal ash, mining waste, demolition waste.

Environmental monitoring around landfills. Detection, control and remediation of subsurface contamination.

UNIT – IV

Soil remediation, investigation of contaminated soil, insitu/exiture mediations, bio-remediation, thermal remediation, pump and treat method, phyto remediation and electro kinetic remediation.

Suggested Readings:

1. D.E. Daniel, Geotechnical Practice for Waste Disposal, Chaman & Hall, London.
2. Lakshmi N. Reddy, Hilary. I. Inyang – Geo-Environmental Engineering – Principles and Applications – Makcel Dekker Ink, 2000
3. Rowe R.K., "Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, 2000.
4. Sharma H.D. and Reddy K.R., "Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, Inc., USA, 2004
5. Yong, R. N., "Geoenvironmental Engineering, Contaminated Soils, Pollutant Fate, and Mitigation" CRC Press, New York, 2001.

Note: Latest edition of books is to be referred.

BT CE 801A: MAJOR PROJECT
B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|----------|----------|-----------|---------------|
| -- | -- | 20 | 10 |

The primary objective of this course is to develop in students the professional quality of synthesis employing technical knowledge obtained in the field of Engineering & Technology through a project work involving design, analysis augmented with creativity, innovation and ingenuity.

Project involving design/ fabrication/ testing/ computer simulation/ case studies etc. which commences in the VII Semester will be completed in VIII Semester and will be evaluated through a panel of examiners consisting of the following:

| | |
|---------------------------------|------------------|
| Head of Department : | Chairperson |
| Project coordinator : | Member Secretary |
| Respective project supervisor : | Member |

The student will be required to submit two copies of his/her project report to the department for record (one copy each for the department and participating teacher).

Project coordinator will be assigned the project load of maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

The format of the cover page and the organization of the body of the report for all the B.Tech. will be finalized and circulated by the Project coordinator.

BT CE 801A: INDUSTRIY INTERNSHIP

B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|----------|----------|-----------|---------------|
| -- | -- | 20 | 10 |

The students are required to undergo Industrial Training in State/Central PWD, Railways and other Originations or Institutional Project Work of duration not less than 4 months in a reputed organization or concerned institute. The students who wish to undergo industrial training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the report at the university. The typed report should be in a prescribed format. The report will be evaluated by a Committee consisting of teachers from different specialization to be constituted by the Head of the department. The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization.

The student will interact with the committee through presentation to demonstrate his/her learning.

The final viva-voce of the Industrial Training will be conducted by an external examiner and one internal examiner appointed by the university. External examiner will be from the panel of examiners submitted by the concerned department. Assessment of Industrial Training will be based on seminar, viva-voce, report and certificate of Industrial Training obtained by the student from the industry.

The internal marks distributions for the students who have undergone Industrial Training consist of 30 marks by the committee members consisting of faculty members of concerned department and 70 marks by the external expert.

The teachers engaged for Industrial Internship work shall have a workload of 2 hours per group (at least 4 students) per week.

BT CE 802A: DISASTER MANAGEMENT
B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|----------|----------|----------|---------------|
| 3 | -- | -- | 3 |

Course Outcomes

CO1: Know the significance of disaster management,

CO2: Study the occurrences, reasons and mechanism of various types of disaster

CO3: Learn the preventive measures as Civil Engineer with latest codal provisions

CO4: Apply the latest technology in mitigation of disasters

UNIT-I

Introduction: Disaster, Emergency, Hazard, Mitigation, Disaster Prevention, Preparedness and Rehabilitation, Risk and Vulnerability, Classification of Disaster, Natural and Manmade Disasters, International day and Decade of Disaster Reduction.

Risk and Vulnerability to disaster mitigation and management options, Warning and Forecasting

UNIT-II

Hydro-Meteorological Based Disasters: Disaster Management Act 2005, Role of NDMA, NDRF, NIDM, Tropical Cyclones, Floods, droughts, mechanism, causes, role of Indian Metrological Department, Central Water Commission, structure and their impacts, classifications, vulnerability, Early Warning System, Forecasting, Flood Warning System, Drought Indicators, recurrence and declaration, Structural and Nonstructural Measures.

Desertification Zones, causes and impacts of desertification, Characteristics, Vulnerability to India and Steps taken to combat desertification, Forest Fires; Causes of Forest Fires; Impact of Forest Fires, Prevention.

UNIT-III

Geological Based Disasters: Earthquake, Reasons, Compression, Shear, Rayleigh and Love Waves; Magnitude and Intensity Scales, Direct and Indirect Impact of Earthquake; Seismic Zones in India, Factors, Indian Standards Guidelines for RCC and Masonry Structures, Prevention and Preparedness for Earthquake, Tsunamis, Landslides and avalanches: Definition, causes and structure; past lesson learnt and measures taken; their Characteristic features, Impact and prevention, Atlas (BMTRPC); structural and non structural measures.

UNIT-IV

Manmade Disasters: Chemical Industrial hazards; causes and factors, pre- and post disaster measures; control ; Indian Standard Guidelines and Compliance; Traffic accidents; classification and impact, Fire hazards; Classification as per Indian Standards; Fire risk assessment; Escape routes; fire fighting equipments; classification of buildings, fire zones, occupancy loads; .capacity and arrangements of exists, Use of remote sensing and GIS in disaster mitigation and management.

Suggested Readings:

1. Abbott, Patrick Leon, *Natural Disasters*, Amazon Publications, 2002
2. Gauba Nidhi, Dhawan and Khan, Ambrina Sardar, *Disaster Management and Preparedness*, CBS Publishers & Distribution
3. Oosterom, Petervan, Zlatanova, Siyka, Fendel, Elfriede M., *Geo-information for Disaster Management*, Springer Publications, 2005
4. Schneid., Thomas D., *Disaster Management and Preparedness*, CRC Publication, USA, 2001
5. Singh, Savindra and Singh, Jeetendra, *Disaster Management*, Pravalika Publications, Allahabad
6. Wisner., Ben, *At Risk: Natural Hazards, People vulnerability and Disaster*, Amazon Publications, 2001

Note: Latest Edition of Books is to be taken.

ELECTIVE-I

BT CE 821A: PAVEMENT EVALUATION AND MANAGEMENT

B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|---|----|----|--------|
| 3 | -- | -- | 3 |

Course Outcomes

- CO1. Assess pavement surface conditions and evaluate it.
- CO2. Estimate the structural stability of pavements using various tests.
- CO3. Design the overlay for a flexible pavement.
- CO4. Design the overlay for a rigid pavements.
- CO5. Differentiate amongst various design alternatives for pavements.
- CO6. Demonstrate the ability to discuss pavement management system

UNIT –I

Pavement Evaluation and Performance: General concept of pavement evaluation, evaluation of pavement performance, evaluation of pavement structural capacity, evaluation of pavement distress, evaluation of pavement safety.

Types of Distress: Structural and functional, serviceability, fatigue cracking, pavement deformation and low temperature shrinkage cracking, Factors affecting performance, relation between performance and distress.

UNIT-II

Pavement Evaluation & Measuring Equipment: Functional & Structural Evaluation, Functional Parameters such as Roughness, Distress, Rutting, Skid Resistance etc. Structural Parameters such as Structural Capacity. Benkelman Beam, Bump Integrator, dynaflect. Demonstration of equipment for dynamic testing of pavements. Digital ultrasonic concrete tester. Pavement skid resistance measuring equipment, fatigue testing equipment.

UNIT –III

Pavement Overlays: Flexible overlays and determination of overlay thickness. Rigid overlays and determination of overlay thickness. Design of Overlay by Benkelman Beam and Falling Weight Deflectometer.

Design Alternatives: Framework for pavement design, design objectives and constraints, Basic structural response models, characterization of physical design inputs, Generating alternative pavement design strategies. Economic evaluation of alternative pavement design strategies, analysis of alternative design strategies. Predicting distress, predicting performance, selection of optimal design strategies.

UNIT – IV

Pavement Management System: Introduction to Pavement Management System (PMS) & Maintenance Management System (MMS), construction, maintenance and rehabilitation. Feedback data system. Examples of Working Design and Management Systems. Implementation of a pavement management system.

Suggested Readings

1. Fwa, T.F., *The Handbook of Highway Engineering*, CRC Press, Taylor & Francies Group, 2006.
2. Hass, R., Hudson, W.R. and Zaniewski, J., *Modern Pavement Management*, Krieger 1994.
3. Khanna and Justo, *Highway Engineering*, Nem Chand & Brothers, Roorkee 2015

Note: Latest Edition of Books is to be taken.

ELECTIVE-II
BT CE 822A: AIRPORT PLANNING AND DESIGN
B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|----------|-----------|-----------|---------------|
| 3 | -- | -- | 3 |

Course Outcomes

- CO1. Define different surveys pertaining to airport planning.
- CO2. Classify different types of airports and their sections.
- CO3. Interpret various design factors to design airport pavements.
- CO4. Relate to the concepts of capacity – delay and space – time for airports.
- CO5. Describe various obstructions and clearance requirements in airports.

UNIT –I

Airport Planning: Airport master plan, aircraft characteristics related to airport planning, air traffic demand analysis, planning surveys, airport zoning.

Geometric Design: Airport classification, runway and taxiway geometric standards, exit taxiways, separation and clearances.

UNIT-II

Terminal Area: Facilities, space requirement, number and size of gate positions, aircraft parking system.

Visual Aids: Airport day-time markings, airport lighting, visibility, visual aids.

UNIT –III

Structural design of airport pavements: Design Factors, Design of flexible and rigid pavements.

Airside capacity and delay: Overview of mathematical models for capacity and delay, space time concept, models for mixed traffic.

UNIT – IV

Air Traffic Control: Importance of flight rules, navigational aids, air traffic controls, obstruction and clearance requirements.

Airport Drainage: Design run-off, inlet size and location design, surface and subsurface design.

Suggested Readings

1. Ashford, N. and Wright, P. H., *Airport Engineering*, John Wiley & Sons, NY. 1992
2. Horonjeff, Robert and McKelvey, Francis X., *Planning & Design of Airports*, McGraw Hill, Inc., 1993.
3. Khanna, S. K., Arora M. G., and Jain, S. S., *Airport Planning & Design*, Nem Chand and Bros., Roorkee 2004.

Note: Latest Edition of Books is to be taken.

ELECTIVE-III

BT CE 823A: GROUND WATER ENGINEERING

B. Tech. 4th Year (Semester –VIII)

| L | T | P | Credit |
|---|----|----|--------|
| 3 | -- | -- | 3 |

Course Outcomes

CO1. Learn the properties of aquifers and equation of motions.

CO2. Understand the boundaries effect and thiem's equilibrium formulas

CO3. Understand the construction and working of tube wells and their failures

CO4. Learn the various artificial method of recharge of ground water.

UNIT –I

Properties of Aquifers, Formation constants, compressibility of aquifers, Equation of motion for steady and unsteady ground water flow in isotropic homogeneous aquifers, Dupit's assumptions. Unconfined flow with a recharge, tile drain problem. Ground water exploration and methods of investigations.

UNIT-II

Effect of boundaries, interference of water, leaky aquifers, Thiem's equilibrium formula for unconfined and confined aquifers and determination of hydraulic properties of aquifers. Partial penetration of an aquifer by a well, spherical flow in a well. Non equilibrium formula for aquifer (unsteady radial flows).

UNIT –III

Tube wells, optimum capacity, silting of tube well, design of tube wells in different aquifers, tube well types, parts, bore hole, strainers, its types, well pipe, casing pipe, blind pipe. Construction and working of tube wells, site selection, drilling operation, cable tool method, hydraulic method, rotary method and drilling fluids, well screen assembly installation, verticality and alignment of tube wells, gravel packing, development of tube wells, sickness, in construction and corrosion and failure of tube wells.

UNIT – IV

Artificial recharge of ground water, considerations and methods, recharge techniques induced infiltration, water spreading, flooding, basins, ditching, modification of natural channels, irrigation, recharge pits, shafts and recharge wells.

Suggested Readings

1. Raghunath, H.M., *Groundwater*, Wiley Eastern Ltd., N. Delhi
2. Todd, D.K., *Groundwater Hydrology*, John Wiley & Sons Inc., New York

Note: Latest Edition of Books is to be taken.

ELECTIVE-IV
BT CE 824A: WATERSHED MANAGEMENT
B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|----------|-----------|-----------|---------------|
| 3 | -- | -- | 3 |

Course Outcomes

- CO1: Know the importance of watershed management
- CO2: Understand the effects of watershed on community
- CO3: Learn the concept of land drainage management
- CO4: Apply the system water harvesting.

UNIT-I

Watershed Management Concept - Introduction- Concept of Watershed Management- History of Watershed Management and its Relevance to India- Watershed Characteristics; Climatic Characteristics- Physiographic Characteristics- Causes of Watershed Deterioration.

UNIT-II

Effect of Watershed on the Community- Water Resources Region of India Principles of Watershed Management- Integrated Watershed Management Approach (IWMA)- Objectives of IWMA- Envisaged Results- Success Criteria- Selection of Watershed Village

UNIT-III

Inadequate Surface and Subsurface Drainages- Remedial Measures in Wasteland Management- Land Drainage Management- Surface or Overland Drains, Subsurface or Underground Drains- Discharge and Spacing of tile Drain.

UNIT-IV

Flood Damage Mitigation Management - Introduction- Mitigation Measures- Structural Mitigation Measures- Non-Structural Mitigation Measures- Flood Plain Zoning- Flood Forecasting.
Water Harvesting- Introduction- Techniques of Water Harvesting- Indigenous Water Harvesting Methods in India- Engineering Methods of Water Harvesting.

Suggested Readings:

1. James L.D., and Lee, R. R., Economics of Water Resources Planning, McGraw Hill Publishing Company, New York.
2. Linsely et al., *Water Resource Engineering*, McGraw Hill Publishing Company, New York.
3. Loukes et al., *Water Resources Systems Planning and Analysis*, Prentice Hall of India, New Delhi
4. Roy, S.S., *Optimisation Theory and Applications*
5. Varshney, R.S., *Water Resources Systems Planning & Economics*

Note: Latest Edition of Books is to be taken.

GENERAL ELECTIVE I

BT CE-731A: ELEMENTS OF EARTHQUAKE ENGINEERING

B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|---|---|----|--------|
| 3 | 1 | -- | 4 |

Course Outcomes

CO1. Acquire knowledge of engineering seismology

CO2. Analyze the earth quake forces on buildings

CO3. Learn the design philosophies of earthquake resistant structures using IS codes 1893:2002

CO4. Evaluate the condition of the existing RC and masonry buildings.

UNIT –I

Engineering Seismology: Engineering seismology, Seismic zones of India, Earthquake and its causes, Types of waves, location of earthquakes, seismograph, Impact of Earthquake.

UNIT-II

Earthquake Resistant Design: Philosophy of Earthquake resistant Design, Design Consideration, Construction Details, Architectural General guidelines for Masonry buildings, RC buildings and non structural elements.

UNIT –III

Earthquake Forces: Seismic coefficient and response spectrum method of analysis as per IS 1893 Codal Provisions. Examples on seismic force calculation of buildings.

UNIT – IV

Seismic Vulnerability Assessment: Seismic evaluation of building, Rapid visual Inspection simplified and detailed vulnerability assessment, Detailed In-situ investigation, Non-destructive test, Partially destructive test.

Suggested Readings

1. Agarwal, Pankaj, *Earthquake Resistant Design of Structures*, PHI learning Private Limited, 2011
2. Aggrawal, M. M., *Railway Engineering Second Edition.*, Oxford Publication, 2013.
3. Chopra, Anil Kr., *Structural Dynamics*, Pearson, 2007
4. Clough and Penzian, *Dynamics of Structures*, McGraw Hill Publishing Co., New York, 1993
5. Paz, Mario, *Structural Dynamics (Theory and Computation)*, CBS Publishers and Distributors, 2004
6. Roy, R. Carig, Jr., *Structural Dynamics (An Introduction to computer methods)*, John Wiley & Sons

Note: Latest Edition of Books is to be taken.

GENERAL ELECTIVE II
BT CE-732A: ROAD SAFETY AUDIT
B. Tech. 4th Year (Semester – VII)

| L | T | P | Credit |
|----------|----------|-----------|---------------|
| 3 | 1 | -- | 4 |

Course Outcomes

CO1. Understand road safety scenario in India and World

CO2. Gain in-depth knowledge on road safety auditing process

CO3. Develop critical thinking for developing safe system approach and to understand traffic calming measures

CO4. Understanding the road safety engineering and crash investigation techniques.

UNIT –I

Road Safety Scenario Introduction to Road Safety scenario in India and World, Road Accident Characteristics, Need of Planning for Network, Land Use and Road Environment for Safety

UNIT-II

Road Safety Auditing Introduction to Road Safety Auditing, concept and need of Road Safety Audit (RSA), procedures in RSA, design standards, audit tasks, stages of road safety audit, Road Safety Audit types, road design issues in RSA's. Overview of Road Safety Hazards, Traffic Calming measures.

UNIT –III

Safe System Approach A global perspective, speed management & safety, safe system and speed & assessing speed limit, type of speed limit & speed zone signs, infrastructure to support safe speed feedback and enforcement.

UNIT – IV

Road Safety Engineering & Crash Investigation Introduction to Road Safety Engineering & Crash Investigation, Human factors relating to crashes, crash investigation & crash problem diagnosing, crash costing, economic appraisal, safety provisions for workers at construction site, construction zone markings, signs, etc.

Suggested Readings

1. Babkov, V.F. *Road conditions and Traffic Safety*, MIR publications 1975
2. IRC:99-2018 "Guidelines for Traffic Calming Measures in Urban and Rural Areas"
3. IRC:119-2015 "Guidelines for Traffic Safety Barriers"
4. Khanna and Justo, *Highway Engineering*, Nem Chand & Brothers, Roorkee 2015
5. L.R. Kadyali, *Highway Engineering*, Nem Chand & Brothers, Roorkee 2015
6. Road Safety Audit Manual (IRC:SP-88-2019)

Note: Latest Edition of Books is to be taken.

GENERAL ELECTIVE III
BT CE 831A: DISASTER MANAGEMENT
B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|----------|----------|-----------|---------------|
| 3 | 1 | -- | 4 |

Course Outcomes

CO1: Know the significance of disaster management,

CO2: Study the occurrences, reasons and mechanism of various types of disaster

CO3: Learn the preventive measures as Civil Engineer with latest codal provisions

CO4: Apply the latest technology in mitigation of disasters

UNIT-I

Introduction: Disaster, Emergency, Hazard, Mitigation, Disaster Prevention, Preparedness and Rehabilitation, Risk and Vulnerability, Classification of Disaster, Natural and Manmade Disasters, International day and Decade of Disaster Reduction.

UNIT-II

Hydro-Meteorological Based Disasters: Role of NDMA, NDRF, NIDM, Tropical Cyclones, Floods, droughts, mechanism, causes, role of Indian Metrological Department, Early Warning System, Forecasting, Flood Warning System, Drought Indicators.

Desertification Zones, causes and impacts of desertification, Forest Fires; Causes of Forest Fires; Prevention.

UNIT-III

Geological Based Disasters: Earthquake, Reasons, Compression, Shear, Rayleigh and Love Waves; Magnitude and Intensity Scales, Direct and Indirect Impact of Earthquake; Seismic Zones in India, Factors, Indian Standards Guidelines for RCC and Masonry Structures, Prevention and Preparedness for Earthquake, Tsunamis, Landslides: Definition, causes and structure; past lesson learnt and measures taken.

UNIT-IV

Manmade Disasters: Chemical Industrial hazards; causes and factors, pre- and post-disaster measures; control; Indian Standard Guidelines and Compliance; Traffic accidents; classification and impact, Fire hazards; Fire risk assessment; Escape routes; firefighting equipment; classification of buildings, fire zones, occupancy loads; capacity and arrangements of exists.

Suggested Readings:

1. Abbott, Patrick Leon, *Natural Disasters*, Amazon Publications, 2002
2. Gauba Nidhi, Dhawan and Khan, Ambrina Sardar, *Disaster Management and Preparedness*, CBS Publishers & Distribution
3. Oosterom, Petervan, Zlatanova, Siyka, Fendel, Elfriede M., *Geo-information for Disaster Management*, Springer Publications, 2005
4. Schneid., Thomas D., *Disaster Management and Preparedness*, CRC Publication, USA, 2001

5. Singh, Savindra and Singh, Jeetendra, *Disaster Management*, Pravalika Publications, Allahabad
6. Wisner., Ben, *At Risk: Natural Hazards, People vulnerability and Disaster*, Amazon Publications, 2001

Note: Latest Edition of Books is to be taken.

GENERAL ELECTIVE-IV
BT CE 824A: WATERSHED MANAGEMENT
B. Tech. 4th Year (Semester – VIII)

| L | T | P | Credit |
|----------|----------|-----------|---------------|
| 3 | 1 | -- | 4 |

Course Outcomes

- CO1: Know the importance of watershed management
- CO2: Understand the effects of watershed on community
- CO3: Learn the concept of land drainage management
- CO4: Apply the system water harvesting.

UNIT-I

Watershed Management Concept - Introduction- Concept of Watershed Management- History of Watershed Management and its Relevance to India- Watershed Characteristics; Climatic Characteristics- Physiographic Characteristics- Causes of Watershed Deterioration.

UNIT-II

Effect of Watershed on the Community- Water Resources Region of India Principles of Watershed Management- Integrated Watershed Management Approach (IWMA)- Objectives of IWMA- Envisaged Results- Success Criteria- Selection of Watershed Village

UNIT-III

Inadequate Surface and Subsurface Drainages- Remedial Measures in Wasteland Management- Land Drainage Management- Surface or Overland Drains, Subsurface or Underground Drains- Discharge and Spacing of tile Drain.

UNIT-IV

Flood Damage Mitigation Management - Introduction- Mitigation Measures- Structural Mitigation Measures- Non-Structural Mitigation Measures- Flood Plain Zoning- Flood Forecasting.
Water Harvesting- Introduction- Techniques of Water Harvesting- Indigenous Water Harvesting Methods in India- Engineering Methods of Water Harvesting.

Suggested Readings:

1. James L.D., and Lee, R. R., Economics of Water Resources Planning, McGraw Hill Publishing Company, New York.
2. Linsely et al., *Water Resource Engineering*, McGraw Hill Publishing Company, New York.
3. Loukes et al., *Water Resources Systems Planning and Analysis*, Prentice Hall of India, New Delhi
4. Roy, S.S., *Optimisation Theory and Applications*
5. Varshney, R.S., *Water Resources Systems Planning & Economics*

Note: Latest Edition of Books is to be taken.