College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra, Permanently Affiliated to S.P. Pune University)

Department of Civil Engineering

Curriculum Structure & Detailed Syllabus (UG Program)

Third Year B. Tech. Civil Engineering

(Revision: A.Y. 2019-2023, Effective from: A.Y. 2021-22)

Program Educational Objectives (PEOs):

The Graduates will-

1. Have successful career in the diversified sectors of the engineering Industry and/ or higher studies by acquiring knowledge in mathematical, scientific and engineering fundamentals.
2. Analyse and design Civil Engineering systems with social awareness and responsibility.
3. Exhibit professionalism, ethical approach, communication skills, team work in their profession and adapt to modern trends by engaging in lifelong learning.

Program Outcomes (POs):

On successful completion of the program, Graduates will be able to

1. Apply knowledge of mathematics, science and engineering to Civil Engineering problems.
2. Identify, formulate, research literature and solve complex Civil Engineering problems.
3. Design various structures or particular system that meets desired specifications and requirements.
4. Design and conduct experiments, interpret and analyse data, synthesize the information to provide conclusion.
5. Select and use appropriate engineering techniques and software tools to analyse Civil Engineering problems with understanding of limitations.
6. Assess local and global impact of societal issues on Civil Engineering profession.
7. Able to understand the impact of engineering solutions on society and demonstrate the knowledge of and need for sustainable development.
8. Demonstrate their professional and ethical responsibilities.
9. Able to function as a member or a leader on engineering and science laboratory teams, as well as on multidisciplinary teams.
10. Communicate effectively in both verbal and written forms.
11. Understand engineering and management principles and apply to their work as a member and/ or leader in a team to manage projects.
12. Adapt transform in industry by understanding the need of independent and lifelong learning.

Program Specific Outcomes (PSOs):

PSO1- Survey, map, plan and mark layouts for buildings, alignments for canals, roads, rail lines and other structures.

PSO2-Specify, analyze, design, supervise, construct, maintain, test and evaluate different structures with quality and safety aspect.

PSO3-Plan, analyze, design, construct, maintain and rehabilitate the water resources systems with effectiveness and sustainable environment considerations.

Correlation between PEOs and POs

PO→ PEO↓	1	2	3	4	5	6	7	8	9	10	11	12
1.	✓	✓	✓		✓						✓	
2.		✓	✓	✓	✓		✓					
3.						✓	✓	✓	✓	✓	✓	✓

Correlation between PEOs and PSOs (from 2019)

PSO→ PEO↓	1	2	3
1.	✓	✓	✓
2.		✓	✓
3.	✓	✓	✓

List of Abbreviations

Sr. No.	Abbreviation	Stands for:
1	PCC	Program Core Course
2	DEC	Departmental Elective Course
3	SBC	Skill Based Course
4	LC	Laboratory Course
5	HSSC	Humanities and Social Science Course
6	MLC	Mandatory Learning Course
7	IOC	Interdisciplinary Open Course
8	BSC	Basic Science Course
9	IFC	Interdisciplinary Foundation Course

CURRICULUM STRUCTURE OF T. Y. B. TECH (CIVIL)

Effective from A. Y. 2021-2022

V-Semester:

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1	MLC	ML 21002	Environmental Studies	1	--	--	--
2	IFC	IFC/ET 21001	Interdisciplinary Foundation Course-III - Internet of Things and Applications	2	--	--	2
3	HSSC	AS(HS) 21005 AS(HS) 21006 AS(HS) 21007 AS(HS)21008	Humanities and Social Sciences Course-II • Industrial Psychology • Personnel Psychology • Engineering Economics • Finance for Engineers	2	--	--	2
4	SBC	CE 21001	Skill focused laboratory course of the domain – Survey Camp	--	--	2	1
5	PCC	CE 21002	Design of Steel Structures	3	--	--	3
6	PCC	CE 21003	Engineering Geology	3	--	--	3
7	PCC	CE 21004	Geotechnical Engineering	3	1	--	4
8	PCC	CE 21005	Transportation Engineering	4	--	--	4
9	LC	CE 21006	Design of Steel Structures Lab	--	--	2	1
10	LC	CE 21007	Engineering Geology Lab	--	--	2	1
11	LC	CE 21008	Geotechnical Engineering Lab	--	--	2	1
12	LC	CE 21009	Transportation Engineering Lab	--	--	2	1
				Total			**23**

- ONE Honours course [To be offered to Students of Host Department]
- ONE Minor course [To be offered to the Students from Other Departments]

1	HON	CE(HO) 21001	Advanced Structural Mechanics	3	--	--	3
2	HON	CE(HO) 21002	Advanced Building Planning and Design	3	--	--	3
3	HON	CE(HO) 21003	Land and Water Management Engineering	3	--	--	3
4	MINOR	CE(MI) 21001	Construction Materials and Building Design	3	--	--	3

VI-Semester:

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1	BSC	MA 21002	Probability and Statistics for Engineers	2	1	--	3
2	MLC	ML 21001	Constitution of India	1	--	--	--
3	HSSC	AS(HS) 21001 AS(HS) 21002 AS(HS) 21003 AS(HS) 21004	Humanities and Social Sciences Course-I • English Proficiency Language • German Language • Japanese Language • Spanish Language	2	--	--	2
4	HSSC	HS 21001	Entrepreneurship Principles and Process	1	--	--	1
5	SBC	CE 21010	Mini project: D-S-P-T • [Design-Simulate-Prototype-Test]	--	--	4	2
6	IOC	IOC/CE 21017	Interdisciplinary Open Course-I • Geoinformatics and Applications	2	--	--	2
7	DEC	CE(DE) 21001 CE(DE) 21002 CE(DE) 21003 CE(DE) 21004 CE(DE) 21005 CE(DE) 21006	Department Elective -I/Industry floated Course/Co-Taught Course 1. Advanced Surveying 2. Design of Hydraulic Structures 3. Foundation Engineering 4. Green Building Practices 5. Matrix Analysis of Structures 6. Computational Methods in Civil Engineering	3	--	--	3
8	PCC	CE 21011	Construction Management	3	--	--	3
9	PCC	CE 21012	Design of RC Structures	3	--	--	3
10	PCC	CE 21013	Hydrology and Water Resources Engineering	3	1	--	4
11	LC	CE 21014	Construction Management Lab	--	--	2	1
12	LC	CE 21015	Design of RC Structures Lab	--	--	2	1
13	LC	CE 21016	Water Resources Engineering Lab	--	--	2	1
				TOTAL			**26**
		Total Academic Engagement and Credits (Max)					**25**

1	HON	CE(HO) 21004	Advanced Mechanics of Materials	3	--	--	3
2	HON	CE(HO) 21005	Advanced Geotechnical Engineering	3	--	--	3
3	MINOR	CE(MI) 21002	Fundamentals of Geomechanics	3	--	--	3

Semester V

MLC/ML21002 ENVIRONMENTAL STUDIES

(Adopted from the 'Ability Enhancement of Compulsory Courses: Environmental Studies' as prescribed by the Expert Committee of University Grants Commission as per directives of Hon'ble Supreme Court)

Teaching Scheme
Lectures: 1 hr/week

Examination Scheme
Periodic Assignments & Tests
Assignment: 2 hrs/week

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Comprehend Sustainable Development Goals for present generation. [PEO2][PO7, PSO3]
2. Appreciate environmental resources, functioning of an ecosystem, significance of biodiversity and environmental challenges. [PEO2][PO7, PSO3]
3. Analyze the current status of environment with respect to precautionary mechanisms and control measures. [PEO2][PO7, PSO3]
4. Appreciate the role of an engineer for better tomorrow. [PEO2][PO7, PSO3]

Unit 1 **(2 hrs)**

Multi disciplinary nature of environmental studies:
Definition, scope and importance
Need for public awareness.

Unit 2 **(8 hrs)**

Natural Resources: Renewable and non-renewable resources:
Natural resources and associated problems.
Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts overwater, dams-benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
Food resources : World food problems, changes caused
by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit 3 **(6 hrs)**

Ecosystems:
Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 4 **(8 hrs)**

Biodiversity and its conservation:
Introduction – Definition : genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Unit 5 **(8 hrs)**

Environmental Pollution:
Definition, Cause, effects and control measures of :- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management : Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides.

Unit 6 **(7 hrs)**

Social Issues and the Environment:
From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Case Studies, Environmental ethics : Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies, Wasteland reclamation, Consumerism and waste products. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Unit 7 **(6 hrs)**

Human Population and the Environment:
Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

Unit 8 **(5 hrs)**

Field work:
Visit to a local area to document environmental assets river / forest / grassland / hill / mountain
Visit to a local polluted site - Urban / Rural / Industrial / Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hill slopes, etc.

Reference Book:

1. Agarwal, K. C. 2001 Environmental Biology, Nidi Publication Ltd., Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R. S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W. P. Cooper, T. H. Gorhani, E & Hepworth, M. T. 2001,
6. Environmental Encyclopedia, Jaico Publication House, Mumbai, 1196p
7. De A. K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment (R)
9. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
10. Hawkins R. E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)

IFC/ET 21001 INTERNET OF THINGS AND APPLICATIONS

Teaching Scheme
Lectures: 1 hr/week
Practical: 2hrs/week

Examination Scheme :100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:
1. Understand the concepts of Internet of Things [PEO3][PO9, PO12]
2. Analyze basic communication protocols [PEO3][PO9, PO12]
3. Implement basic IoT applications using IoT platforms [PEO3][PO5, PO9, PO12]
4. Design IoT applications in diverse domain and analyze their performance [PEO3][PO5, PO9, PO12]

Unit 1 **(10 hrs)**

Fundamentals of Internet of Things:
Introduction to IoT, Basics of Networking, Sensors (transducers) Actuators, Communication Protocols, Arduino and Raspberry Pi, Cloud Computing, SDN - Network requirements, SDN for IoT, Data management and Analytics, Challenges in IOT implementation.

Unit 2 **(4 hrs)**

IoT Applications:
Case study: Smart Grid, Smart Agriculture, Smart Environment, Smart Health Care, Smart Transportation

List of Experiments:

Experiments based on Python Programming:

1. a) Study and Install Python in Linux and WAP for data types in python.
   b) Write a program for arithmetic operation in Python.
   c) Write a program for looping statement in Python.
2. Write a program for Encryption in python
3. Write a program for Decryption in Python

Experiments based on Hardware:

1. Install IDE of Arduino and different types of Arduino.
2. Write program using Arduino IDE for a) Blink LED. b) Implementing RFID, NFC.
3. Write program for monitor temperature using Arduino.
4. Implement MQTT protocol using Arduino.
5. Configure Raspberry Pi and WAP for LED blink.
6. Implement Zigbee Protocol using Arduino / Raspberry Pi
7. IoT case study implementation

Textbooks:

1. Bahga, Arshdeep, and Vijay Madisetti, "Internet of Things: A hands-on approach." Vpt, 2014.
2. Misra, Sudip, Anandarup Mukherjee and Arijit Roy. "Introduction to IoT". Cambridge University Press, 2021

Reference Book:

1. David, Etter, "IOT (Internet of Things) Programming A Simple and Fast Way of Learning IOT." Kindle Edition (2016).
2. S. Misra, C. Roy, and A. Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0." CRC Press, 2020.
3. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016

Humanities and Social Sciences Open Courses-II
HSSC/AS(HS)21005 INDUSTRIAL PSYCHOLOGY

Teaching Scheme
Lectures: 2 hrs/week

Examination Scheme
Assignment/Test: 40 marks
Final Assessment: 60 marks
[Field Visit/Expert Lecture Report: 20 marks
Mini-Project Report: 40 marks]

Course Outcomes:

At the end of the course, student will demonstrate the ability to:

1. Determine the psychological factors that influence individual differences at work and appraise the role of research. [PEO3][PO8, PO12]
2. Explain the concepts of motivation and job satisfaction at work and utilize the elements of organizational culture for enhancing group/team behavior. [PEO3][PO9, PO11, PO12]
3. Evaluate the relevance & functioning of leadership & diversity in workforce and acknowledge the multicultural factors influencing workplace behavior. [PEO3][PO9, PO11, PO12]
4. Illustrate the process of recruitment & selection and Experiment with the information required to sustain employability. [PEO3][PO9, PO10, PO11]
5. Interpret the nuances of Human Factors in Engineering and analyze its role in their disciplines. [PEO3][PO8, PO9, PO11]
6. Measure the behavioral findings from self-lead projects and Propose corrective actions to improve quality of workplace behavior. [PEO3][PO8, PO9, PO11]

Unit 1 **(6 hrs)**

Basics of Industrial Psychology (IP):
Difference between IP & Business Programs; Major fields & Employment in IP
Brief History- Scientific Management, Time and Motion Study, Hawthorne Studies, World War I & II
Research in Social Sciences
Individual Differences at Work: Personality, Intelligence, Emotional Intelligence, Creativity & Innovation, Perception & Attitudes

Unit 2 **(8 hrs)**

People at Work:
Motivation & Job Satisfaction- Employee Predisposition, Expectations, Goals, Incentives& Equity; Job Characteristic Theory (Diagnostic Model)
Understanding Groups & Teams- Group dynamics, Factors affecting Group performance; Understanding work teams, Types of teams, Team development, Issues with teamwork
Leadership (Co-Teaching 4 hrs)- Leader characteristics, Leader & situation, Leader & follower; Specific leadership skills, Introduction to Organizational Development (OD)
Diversity- Multiculturalism- Hofstede's theory, Diversity dynamics

Unit 3 **(8 hrs)**

Human Factors Engineering (HFE):
Introduction & Brief History of HFE; Essentials of HFE
Person-Machine Systems- Basic Human Factors: Sensory systems, Perception, Cognition, Information Processing approach, Memory, Decision Making
Workspace Designs- General Principles, Designing work areas; Machine Displays &Controls; Physical work environment & Anthropometry; Managing workplace strain through Ergonomics (Self-study)
Current trends in HFE- Use of artificial intelligence, cognitive engineering, socio-technical systems, etc.

Unit 4 **(6 hrs)**

Managing People at Work:
Job Analysis-Brief Background, Types & Importance; Job description
Recruitment & Selection-Overview, Process, Evaluation
Gearing for Selection- Interviews & Job Search Skills
Performance Appraisal (Co-Teaching 2 hrs): Steps in the Evaluation Process; Appraisal Interview

Textbooks:

1. Aamodt, M.G. (2013). Industrial Psychology. Cengage Learning: Delhi.
2. Wickens, C. D.; Lee, J. D., Liu, Y. & Gordon Becker, S. E. (2015). An Introduction to Human Factors Engineering. 2nd Edition. Pearson Education: New Delhi.
3. Landy, F. J. & Conte, J. M. (2010). Work in the 21st Century: An Introduction to Industrial and Organizational Psychology. 2nd Edition. Wiley India: New Delhi.

Reference Book:

1. Matthewman, L., Rose, A. & Hetherington, A. (2009). Work Psychology. Oxford University Press: India.
2. Schultz, D. & Schultz, S. E. (2013). Psychology and Work Today: An Introduction to Industrial and Organizational Psychology, 7th Edition, Pearson Education: New Delhi.
3. Schultz, D. & Schultz, S. E. (2002). Psychology and Work Today. Pearson Education: New Delhi.

HSSC/AS(HS)21006 PERSONNEL PSYCHOLOGY

Teaching scheme
Lectures:2 hrs/week

Examination scheme
Assignments: 70 marks
End Semester Exam.: 30 marks

Course Outcomes:

At the end of the course, student will demonstrate the ability to:

1. Acquire organizational concepts and will recognize their own personality attributes suitable for corporate world. [PEO3][PO8, PO9, PO11]
2. Realize the importance of motivation and apply motivational principles to their lives [PEO3][PO8, PO9, PO11]
3. Experience group dynamics and apply those principles in their lives
4. Grasp and apply different techniques to maintain mental health. [PEO3][PO8, PO9, PO11, PO12]

Unit 1 **(6hrs)**

Introduction- Understanding own personality and corporate world:
Basic concepts in Organizational set up and its importance, know own personality attributes. Preparing for corporate world, work ethics, and self- management

Unit 2 **(6 hrs)**

Motivation:
Motivational theories for self- motivation and motivating others at work place, Approaches to work

Unit 3 **(8hrs)**

Group dynamics:
Group behaviour and leadership, Effective group behaviour, Leadership and management principles, virtual teams and Performance appraisal

Unit 4 **(6hrs)**

Mental health at work place:
Occupational stress and conflict and strategies for its management, Emotional Intelligence, spiritual Intelligence

Text Books:

1. Khana S.S.- (2016) Organizational Behaviour(Text and Cases) Chand and company Pvt. Ltd. Delhi.
2. Rae Andr'e :- (2008) organizational behaviour. Dorling Kindersley (India) Pvt. Ltd.
3. Wallace H. and Masters L.- (2008) Personality development, Cengage Learning India Pvt. Ltd.

Reference books:

1. Robbins S, Judge A, Vohra N:- (2013)Organizational behaviour. (15th ed) Pearson Education, Inc.
2. Singh Kavita :- (2010) Organizational behaviour-Text and cases. Dorling Kindersley

HSSC/AS(HS)21007 ENGINEERING ECONOMICS

Teaching Scheme
Lectures: 2 hrs/week

Examination Scheme:100 marks
Assignments/Test - 40 Marks
End Semester Exam. - 60 Marks

Course Outcomes:

1. Demonstrate understanding of economic theories and policies. [PEO3][PO6, PO7]
2. Identify economic problems and solve it by applying acquired knowledge, facts and techniques in the available framework. [PEO3][PO6, PO7, PO11, PO12]
3. Categorize, classify and compare economic situations and draw inferences and conclusions. [PEO3][PO6, PO7, PO11, PO12]
4. Adapt to changing economic atmosphere and propose alternative solutions to the problems. [PEO3][PO6, PO7, PO11]

Unit 1 **(6 hrs.)**

Introduction to Economics:
Definitions, basic concepts of economics: Cost, efficiency and scarcity, Opportunity Cost
Types of economics: Micro Economics, Macroeconomics and Managerial Economics.
Difference between micro economics and macroeconomics. Application of Managerial economics

Unit 2 **(8 hrs.)**

Micro Economics Analysis:
Demand Analysis, Supply Analysis, Theories of Utility and Consumers Choice, Cost analysis, Competition and Market Structures. Application of micro economics theories

Unit 3 **(8 hrs.)**

Macro Economic Analysis:
Aggregate Demand and Supply, Economic Growth and Business Cycles, inflation,
Fiscal Policy, National income, theory of Consumption, savings and investments, Commercial and Central banking. Use of macroeconomic theories.

Unit 4 **(8 hrs.)**

International Economics:
Balance of Trade and Balance of Payments, Barriers to Trade, Benefits of Trade/Comparative Advantage, Foreign Currency Markets/Exchange Rates, Monetary, Fiscal and Exchange rate

policies, Economic Development.
Application of exchange rate policies

Reference Books:

1. Macroeconomics: N. Gregory Mankiw, 2018
2. Managerial Economics: Economic Tools for Today's Decision Makers: by Paul Keat (Author), Philip Young (Author) 2013
3. Principles of Macro Economics: Misra and Puri.2009, Himalaya Publishing House, New Delhi.
4. Modern Microeconomics, A. Koutsoyiannis, Macmillan, London
5. Microeconomics Robert S. Pindyck and Daniel L. Rubinfeld:, Pearson Education Inc. New Delhi
6. Micro economics: K. N. Verma

HSSC/AS(HS)21008 FINANCE FOR ENGINEERS

Teaching Scheme
Lectures: 2 hrs/week

Examination Scheme:100 marks
Assignments - 40 Marks
End Semester - 60 Marks

Course Outcomes:

At the end of the course, student will demonstrate the ability to:
1. Comprehend basics of accounting, cost concepts, will be able to read Financial statements of companies [PEO3][PO6, PO7, PO11, PO12]
2. Enable them to understand critical financial principles and to enable them to integrate & analyze financial information necessary for Business Decision Making.
3. [PEO3][PO6, PO7, PO11, PO12]
4. Establish relationship between Risk & Return, time value of money, sources of finance & working capital [PEO3][PO6, PO7, PO11, PO12]
5. Appreciate the digital platform of future finance, crypto currency, the terms associated with Financial Markets such as Money market, capital market, SEBI & other Regulatory authorities [PEO3][PO6, PO7, PO11, PO12]

Unit 1 **(6 hrs.)**

Introduction to Accounting & Finance:
Basic elements of financial accounting, cost concepts, preparation of Profit & Loss Account & Balance Sheet & concept of Budgetary control

Unit 2 **(6 hrs.)**

Read & interpret Financial Statements:
As per Schedule III of Companies Act 2013, Financial statement analysis, concept of cash flow statement

Unit 3 **(8 hrs.)**

Break-even analysis, Risk & Return relationship, time value of money, sources of finance & working capital

Unit 4 **(4 hrs.)**

Digital Platform such as Net Banking, Crypto currency, Algorithm based stock exchange trading, Basics of Money market, capital market, Commodities market, IPO & Regulatory authorities

****Pedagogy:** Lectures and PPTs, Use of basic Excel tools for preparation of final accounts, Annual Reports of companies.

Reference Books:

1. Accounting for Managers – C Rama Gopal (2012), Accounting for Management, New Age International Publishers
2. Financial Management – Theory and Practice - Prasanna Chandra, McGraw Hill Publication

SBC/CE21001 SURVEY CAMP

Teaching Scheme
Lab.: 2 hours/ week

Examination Scheme: 100 marks
T1 and T2 - 20 marks each
End Sem. Exam - 60 marks

Course Outcomes:

At the end of the course, the students will be able to

1. Use instruments like Auto level, Total station, Tachometer and other important survey instrument. [PEO1][PO1, PO4, PSO1]
2. Gain experience of preparing site maps of the objects in the area under consideration with contours. [PEO1][PO1, PO4, PSO1]
3. Make significant survey decisions on survey works whenever necessary especially when facing problems at sites. [PEO1][PO1, PO4, PSO1]
4. Enhance their confidence to carry out engineering survey work. [PEO1][PO1, PO4, PSO1]

During the survey camp group of students will be formed with a group leader. Necessary survey instruments will be issued to the group. The group of students will be asked to survey a reasonable area by plotting important objects and features of the land.

Students should perform following activities in the survey camp:

1. Road projects
2. Contour projects
3. Plain table surveying
4. Geodetic surveying

Textbooks:

1. Punmia B.C., Surveying, Volume 1, Laxmi Publications.
2. Punmia B.C. Surveying, Volume 2, Laxmi Publications.
3. N N Basak, Surveying and Levelling TMH Private Ltd.

PCC/CE 21002 DESIGN OF STEEL STRUCTURES

Teaching Scheme
Lectures: 3 Hrs/ week

Examination Scheme: 100 Marks
T1 and T2 - 20 marks each
End Sem. Exam. - 60 marks

Course Outcomes:

At the end of the course, the students will be able to

1. Analyze different components of a steel structure.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]
2. Design bolted and welded connections.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]
3. Design tension members.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]
4. Design compression members.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]
5. Design laterally restrained and laterally unrestrained beams.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]
6. Design columns and their foundations.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]

Unit 1 **(7 Hrs)**

Introduction to structural design:
Structural systems, Role of the designer, Advantages of steel as a structural material, Types of structural steel, Mechanical properties of steel, various rolled steel sections (including cold-formed sections, structural pipe (tubes)) sections and their properties
Types of loads acting on structure, Introduction to IS Codes and specifications: IS875, IS800:2007, Design philosophies: Introduction to working stress method, Limit state method, Introduction to Plastic theory: Plastic hinge concept, Plastic collapse load, Plastic moment, Shape factor, Plastic section modulus.

Unit 2 **(7Hrs)**

Design of Connections:
Introduction to rivets, Bolted connections: Types of bolts, Behavior of bolted joints, Strength of joint, efficiency of joint, Analysis and Design of connections, Welded connections: Types and properties of welds, Types of joints, Design of connections, simple connections Beam to beam, beam to column bolted connections and welded connections, Analysis and design of moment resisting bolted and welded connection

Unit 3 **(6 Hrs)**

Design of Tension members:
Introduction to roof trusses, loads acting on truss, Analysis of simple roof truss Tension members Behavior design of tension members, Design of single and double angle sections as tension member.

Unit 4 **(6 Hrs)**

Design of compression member:
Compression Members in truss and buildings, Behavior,
Modes of failure, Classification of cross section, Effective length, slenderness ratio, Design of Compression members in trusses.

Unit 5 **(7 Hrs)**

Design of beams:
Loads acting on beam, buckling behavior, sections used, laterally restrained and unrestrained simply supported beams, Design of compound beams Curtailment of flange plates, Design of welded plate girder.

Unit 6 **(7 Hrs)**

Design of steel column:
Loads acting on columns, sections used, Design of columns subjected to axial load single section, built up column sections, Design of Laced column, Design of Battened columns, Design of Column bases: Slab base, Design of foundation, Introduction to design of Gusseted base.

Text Books:

1. N. Subramanian (2009), "Design of Steel Structures", Oxford University Press.
2. V.L. Shah, V. A. Gore (2015), "Limit State Design of Steel Structures", Structures Publications
3. S.S. Bhavikatti (2012), "Design of Steel Structures by Limit State Method", I. K. International Publishing House Pvt. Ltd., 3rd Edition

Reference Books:

1. Edwin Gaylord and Charles Gaylord (2010), "Design of steel structures", Tata McGraw Hill Publishing company Ltd., New Delhi (3rd Edition)
2. Robert Engle Kirk (2003), "Steel structures: controlling behavior through design", John Wiley and Sons.
3. SP: 6 (1995): Handbook for Structural Engineers

Indian Standard Codes:

1. IS 800 (2007) General Construction in Steel — Code of Practice
2. IS 808 (1989) Dimensions for Hollow Rolled Steel Beam, Column, Channel and Angle Sections
3. IS 875 (Part-I)-1997 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 1: Dead Loads — Unit Weights of Building Materials and Stored Materials (Reaffirmed 1997)
4. IS 875 (Part-II)-1987 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 2: Imposed Loads (Reaffirmed 1997)
5. IS 875 (Part-III)-1987 – Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures Part 3: Wind Loads (Reaffirmed 2003)

PCC/CE21003 ENGINEERING GEOLOGY

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme: 100 Marks
T1 and T2 - 20 marks each
End Sem. Exam. - 60 marks

Course Outcomes:

At the end of the course, the students will be able to-

1. Know the fundamental concepts leading to formation of the Earth; Rocks and Minerals. [PEO1][PO1]
2. Develop the ability to perform basic engineering geological assessments and analysis. [PEO2][PO3]
3. Understand the relevance of Engineering Geology in complex projects which will strengthen their practical understanding of the subject. [PEO3][PO11]
4. Develop a native construction plan incorporating all relevant aspects of geology. [PEO2][PO7]
5. To know the various types of Geological and Natural hazards. [PEO1][PO1]

Unit 1 **(6 Hrs)**

General Geology & Petrology:
Introduction, Object, Scope & Sub-divisions, General Geology, Surface features, External & Internal Agents modifying the earth, weathering, decomposition, earth movements, metamorphism, Rock and minerals. Silicate and non-silicate minerals, rock forming minerals, primary and secondary minerals, essential and accessory minerals. Mineral composition of Igneous Rocks, Textures & textural variation, conditions of cooling of plutonic, hypabyssal, and volcanic rocks. Classification of igneous rocks. Secondary Rocks processes and products of decomposition and disintegration. Transport and deposition, Classification of Sedimentary Rocks. Agents of transportation. Welding and cementation. Grain size classification. Agents and types of metamorphism, Metamorphic textures, Contact cataclastic, dynamo thermal and plutonic metamorphism. Study of common rock types of Igneous, Sedimentary, Metamorphic rocks as prescribed in practical work.

Unit 2 **(6 Hrs)**

Structural Geology:
Outcrop. Dip and strike. Conformable series. Unconformity and overlap. Different types of Faults and folds in rocks. Inlier and Outlier. Modes of occurrence of igneous rocks. Joints Fractures and their engineering characters. Mountains- Mountain building activity, orogenic and epirogenic processes

Unit 3 **(6 Hrs)**

Geomorphology and Historical Geology:
Geological action of running water, river valley development, normal cycle of river erosion, Regional cycle of river erosion, waterfalls, ox-bow lakes, flood plain deposits, delta, Rejuvenation and Resulting features such as canyons, river terraces and incised meanders General principles of stratigraphy, Age of the earth and divisions of the Geological time. Physiographic divisions of India and their characteristics. Geological history of Peninsula. Study of formations in Peninsula and the significance of their structural characters in major

Civil Engineering activities, Economic minerals.

Unit 4 **(6 Hrs)**

Ground water, Building Stones and Stability of Slopes:

Types of Ground water, Water table and depth zones of saturation. Influence of textures and Structures of rocks on groundwater storage and movement, Pervious and impervious rocks. Geological work of groundwater, effects of solution and deposition.

Requirements of good building stone. Dependence of strength, durability, Ease of dressing, availability of blocks of suitable size and appearance on mineral composition Textures and field structures. Suitability of common rocks as building stone.

Causes, Role of water, stability of slopes in consolidated material, influence of dip and slope, safe and unsafe slopes, Prevention of landslides, keeping slopes free from water, retaining walls Vegetation, slope treatment, Precautions to be taken while aligning roads etc. across hills and making cuts in hill slides. Case histories

Unit 5 **(8 Hrs)**

Preliminary Geological Explorations and Introduction to Rock Mechanics:

Verification of surface data by subsurface exploration- Drill holes, test pits, trenches, exploratory tunnels, shafts, adits, drifts, etc. Compilation and interpretation of information obtained from these, Correlation of surface data with results of subsurface exploration.

Limitations of drilling. Comparative reliability of data obtained by drilling and excavation. Engineering significance of Geological structures such as stratification, dips, folds, faults, joints, Fractures, crush zones, fault zones, dykes, etc. Case histories. Introduction to Rock Mechanics in Engineering Geology, Classification of Rocks and Rock Masses Strength and deformability of jointed rock mass, Stability of rock slopes.

Unit 6 **(8 Hrs)**

Tunneling, Dams and Reservoirs:

Influence of geological conditions on design and construction methods, Preliminary Geological investigations for tunnels. Unlined tunnels. Case histories. Dependence of strength, stability and water tightness of foundation rocks and their physical Characters and Geological structures. Influence of geological condition on the choice of type and design of dams. Preliminary geological work on dam sites. Favorable and unsuitable Geological conditions for locating a dam. Precaution to be taken to counteract unsuitable Condition, Treatment of leaky rocks faults, dykes, crush zones, joints, fractures, unfavorable Dips, etc. Earthquakes in regions of dams. Case histories

Dependence of water tightness on physical properties and structure of rocks. Geological Conditions suitable and unsuitable for reservoir sites. Conditions likely to cause leakage through reservoir rims. Importance of ground water studies and effects of raising of the water table. Case histories.

Earth movements, Earthquakes, Interior of the Earth, earthquake zones, Geological considerations for choosing sites of building in seismic area.

Text Books:

1. R. B. Gupte: A Textbook of Engineering Geology (New Edition) ISBN:8185825033 – P.V.G. Publications, Pune
2. N. Chenna Kesavulu: A Textbook of Engineering Geology. 2nd Edition, Macmillan Publishers India Ltd, 2009.

3. Parbin B Singh: Engineering and General Geology. 7thedition, S K Kataria & Sons. New Delhi, 2010.
4. G.B. Mahapatra: Textbook of Physical Geology. CBS Publishers and Distributors India Pvt. Ltd 2018.
5. Introduction to Rock Mechanics by R.E. Goodman, John Wiley & Sons. 2nd Edition ISBN: 978-0-471-81200-*5* November 1988.

Reference Books:

1. R. Legget: Geology and Engineering – McGraw Hill Book Co., London
2. FGH Blyth, and M.H. De Freitas, Geology for Engineers, ELBS. ISBN 9780415502917
3. Engineering Geology and Construction; Fred G. Bell; 1st Edition2004 Taylor & Francis London.
4. Fundamentals of Rock Mechanics, Fourth Edition, April 2007; John Conrad Jaeger, Neville G. W. Cook, Robert Zimmerman ISBN: 978-0-632-05759-7 April 2007 Wiley-Blackwell.

Link for NPTEL Syllabus -

1. https://nptel.ac.in/courses/105/105/105105106/
2. https://nptel.ac.in/content/syllabus_pdf/105105106.pdf

PCC/CE 21004 GEOTECHNICAL ENGINEERING

Teaching Scheme
Lectures: 3 Hrs/ week
Tutorial: 1Hr/ week

Examination Scheme:100 marks
T1 and T2 - 20 marks each
End Sem. Exam. - 60 marks

Course Outcomes:

At the end of the course, the students will be able to

1. Apply basic soil mechanics principles to identify various properties of soil. [PEO1][PO1, PSO2]
2. Compute seepage and draw flow net. [PEO2][PO4, PSO2]
   Select suitable compaction equipment for field compaction. [PEO2][PO4, PSO2]
3. Determine shear strength parameters of soil. [PEO1][PO2, PO5, PSO2], [PEO2] [PO2, PO5, PSO2]
4. Compute bearing capacity and settlement of foundation**.** [PEO2][PO2, PO4, PSO2]
5. Identify various forces acting on the retaining wall and analyse stability of slope. [PEO2][PO2, PO4, PO5, PSO2]

Unit 1 **(6 Hrs)**

Properties of Soil:

Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils, lateritic soils, alluvial deposits and desert soils.

Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance, I.S. classification of soil.

Soil structure: single grained and honey combed, flocculated and dispersed.

Unit 2 **(6 Hrs)**

Permeability and Seepage:
Darcy's law, Factors affecting permeability, Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I)- pumping in test and pumping out test, Permeability of layered soils, Seepage forces, General flow equation. Flow net and its application.

Unit 3 **(6 Hrs)**

Compaction:
Soil compaction phenomenon, Factors affecting compaction. Dry density and moisture content relationship
Zero air voids line, Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720
Field compaction equipment and methods for cohesive and non-cohesive soils.
Consolidation of soil, spring analogy for primary consolidation, Time settlement curve.

Unit 4 **(6 Hrs)**

Shear Strength of Soil:
Mohr's circle, Mohr-coulomb failure criteria, Effective stress concept. Peak and residual shear strength, Factors affecting shear strength, Laboratory measurement of shear strength by direct, unconfined and triaxial tests under different drainage conditions, Vane shear test.

Unit 5 **(6 Hrs)**

a. Stress Distribution of Soil:
Bossiness theory-point load, pressure distribution due to line load, strip load, pressure bulb, introduction to Westergaard theory, approximate stress distribution method

b. Bearing Capacity of Shallow Foundations:
Types of foundations, Terzaghi's and Meyerhoff bearing capacity analysis, effect of various BC factor on bearing capacity, Shear failure criteria, Settlement criteria including consolidation settlement, Introduction to pile foundation.
Use of field test (SPT and Plate Load) data for bearing capacity determination

Unit 6 **(6 Hrs)**

a. Lateral Earth Pressure:
Earth pressure on vertical wall, effect of wall movement on earth pressure, earth pressure at rest, Rankine's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Introduction to Coulomb's theory

b. Stability of Slope:
Slope classification, slope failure, modes of failure. Infinite slope in cohesive and cohesion less soil, slope stability analysis using Swedish Slip Circle Method.

Note- More emphasis would be given on basic fundamentals in the course work.

Tutorial 1	Based on basic index properties of soil
Tutorial 2	Permeability of soil
Tutorial 3	Permeability of soil
Tutorial 4	Compaction and consolidation
Tutorial 5	Field compaction
Tutorial 6	Shear strength of soil
Tutorial 7	Stress distribution of soil
Tutorial 8	Bearing capacity determination of shallow foundation
Tutorial 9	Problems based on earth pressure determination for various condition
Tutorial 10	Problem based on earth pressure for sloping ground.
Tutorial 11	Slope stability Infinite slope in cohesive and cohesion less soil
Tutorial 12	Slope stability Swedish Slip Circle Method.

PCC/CE 21005 TRANSPORTATION ENGINEERING

Teaching Scheme
Lectures: 4 Hrs/ week

Examination Scheme: 100 Marks
T1 and T2 - 20 marks each
End Sem. Exam. - 60 marks

Course Outcomes:

At the end of the course, the students will be able to

1. Formulate the fundamentals of highway, airport, bridge and railway engineering. [PEO1][PO1, PSO1]
2. Demonstrate the components of bridge sub-structure and super-structure, various hydraulics design forces, IRC loadings. [PEO2][PO2, PSO2]
3. Analyze various aspects of airport planning, layout, components of airport, runway, taxiway, heliport, etc. [PEO2][PO4, PSO2]
4. Interpret the knowledge of railway construction, materials used and components, signaling systems. [PEO2][PO7, PSO2]
5. Design the geometrical aspect of Highways and Airports. [PEO2][PO3, PSO2]

Unit 1 **(8 Hrs)**

Highway Engineering:
Role of transportation, scope of road transportation, Highway development in India. Necessity of highway planning and development plans e.g., Nagpur Plan, Bombay plan, Lucknow plan. Classification of Roads Star and grid road pattern, planning and preparation of master plan based on saturation system, determination of road length. Highway alignment and Geometric Design Basic requirement of an ideal alignment and factors controlling it, Engineering survey for highway location, special requirement for hill roads, Design controls and criteria for geometric design, cross sectional element, sight distance requirements, stopping sight distance, overtaking sight distance, overtaking

zones with IRC recommendations, attainment of super elevation, radius of horizontal curves, methods of introduction of extra widening, widening of pavement on horizontal curves, Horizontal transition curves, Design of vertical alignment, gradient and its type, IRC recommendations, grade compensation on horizontal curves, vertical curves, S.S.D. and O.S.D. requirements.

Unit 2 **(8 Hrs)**

Highway Materials and Quality Control:
Importance and properties of sub-grade and pavement component materials, Behavior of materials interaction, tests on aggregate, bituminous materials and bituminous mixes, Marshall stability test. Pavement Design Requirements, factors influencing the flexible and rigid pavement, Flexible pavement 11 design by Group Index Method and C.B.R. method, rigid pavement design, Westergaards analysis of wheel load stresses and temperature stresses in rigid pavement. I.R.C. recommendations. Pavement failure, Construction and maintenance and Quality control, repairs and maintenance. Highway Drainage Importance of drainage, Subsurface and surface drainage systems and their design.

Unit 3 **(7 Hrs)**

Bridge Engineering:
Definition of a bridge, basic components of a bridge, selection of bridge site, factors to be considered while deciding upon the type of structure for a particular bridge site, sub-surface investigation, determination of flood discharge, vertical clearance above HFL, scour depth, afflux, approach used to carry out assessment of design discharge at bridge sites, economic span, abutment pier, recommended design discharge, bridge classification, parameters governing choice of superstructure, span ranges for different type of bridge superstructures usually followed in India.

Unit 4 **(7 Hrs)**

Bridge Engineering: Design Aspects:
Importance of bridge economics in selection of a particular type of superstructure, characteristics and design aspects of various types of superstructures, reference codes, scope of various bridge codes used for reference, forces to be accounted for in the analysis for the design of a bridge , IRC Class AA Loading, IRC Class A Loading, IRC Class B Loading, IRC Class 70R Loading, general points to be taken into account during live load analysis for bridge design Bridge substructure and foundation, choice of type of foundation, general design procedure for design of substructure of a bridge, types of piers and their design aspects, general design procedure for the design of abutments , bearings for bridges, types of bearings, types of bearings recommended for various spans lengths and support, expansion joints for bridge superstructures and their types.

Unit 5 **(10 Hrs)**

Airport Engineering:
Advantage and limitation of air transportation, Aeroplane component parts and important terms Airport planning Aircraft characteristics; which influence Judicious and scientific planning of airports selection of site, survey and drawings to be prepared for airport planning, Major Terminal Components, Functional Relationships of Terminal Components, Objectives in Selecting Terminal Concepts, Airport Master Plan, Factors influencing Terminal Configuration and Size, Forecasts, Terminal Apron Areas. Airport layout:

Characteristics of good layout, runway configuration, imaginary surfaces, location of terminal buildings, aprons and hangers, Zoning requirements regarding permissible heights of construction and landing within the airport boundary, planning aspect of important airports in the world. Runways and Taxiways Runway Location and orientation, wind coverage, use of wind, rose diagram, Basic runway length, corrections for elevation, temperature and gradient as per I.C.A.O and FAA recommendation, Airport classification by I.C.A.O basic recommendation for geometric design standards regarding length, width, longitudinal and transverse gradients and width of safety area, Taxiway System and Aprons, Exit Taxiways, By Pass Taxiways, sight-distance, turning radius and rate of change of longitudinal gradients, Airport Lighting and Markings, VFR Approach and Departure Paths. Heliport Characteristics of helicopter, Nature of helicopter transport, site selection for heliport, Touch Down and Lift off Area, Final Approach and Take off Area, Heliport Markers and Markings.

Unit 6 **(10 Hrs)**

Railway Engineering:

History of Indian Railways, Component parts of railway track, recent development in railways specifically w.r.t. track structure, Organizational structure of Indian railways, railway lines classification based on speeds such as A,B,C,D,E,Q,R and S routes. Permanent way Component Parts Types of rail sections, Coning of wheels, Rail creep, Rail defects, Rail joints, welding of rails, short welded rail (SWR), long welded rail (LWR) & continuously welded rail (CWR), sleepers requirement, Sleeper density, spacing, and types, Rail fittings, Elastic fastenings, bearing plates, anti-creep devices, check and guard rails, Ballast requirements and specification, Formation, Different cross sections of Track in cutting & embankment, suitability of drainage. Points, crossing and turnouts Functions, various types of track junction & their configurations, listing of types of Turnouts. Signaling & Interlocking Objects, classification, control of train movements and monitoring, types of signals, principal of interlocking, Modernization in Railways and railway tracks, High speed tracks.

Text Books:

1. S. K. Khanna, C.E.G. Justo, Nem Chand and Bros, Roorkee (U.A), 8th Edition,2
2. S. K. Khanna, C.E.G. Justo, Highway Material Testing, Nem Chand and Bros, Roorkee (U.A)
3. S.K. Khanna, M.G. Arora, S.S. Jain, Airport Planning and Design, Nem Chand and Bros
4. S.P. Bindra, Bridge Engineering
5. S.C. Rangawala, Principals of Railway Engineering - Charotkar Publishing House.

Reference Books:

1. O'Flaherty, C.A.: Highways Vol 2, Edward Arnold, London.
2. Planning and Design of Airports: 4th Edition, by Robert Horonjeff and Francis McKelvey, McGraw-Hill, 1994.
3. Airport Systems: Planning, Design and Management, by Richard DeNeufville and Amedeo Odoni, McGraw-Hill, 2003
4. S. Ponnuswamy (2008) Bridge Engineering, Tata McGraw-Hill Publishing Co. Ltd, New Delhi
5. Yang H. Huang (2008) Pavement Analysis and Design, Pearson Education, Delhi.
6. J.S. Mundrey, Railways Track Engineering - Tata McGraw Hill, New Delhi.

LC/CE 21006 DESIGN OF STEEL STRUCTURES LABORATORY

Teaching Scheme
Practical**:** 2 Hrs/week

Examination Scheme:100 marks
Continuous Assessment- 50 marks
End Sem. Exam - 50 marks

Course Outcomes:

At the end of the course, the students will be able to

1. Analyze the given structure considering practical approach.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]
2. Design different parts of the given structure using relevant IS codes.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]
3. Prepare the structural drawings suitable for fabrication.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]
4. Correlate the practical and theoretical design aspects.
   [PEO1][PO1, PO2, PO3, PS02], [PEO2][PO2, PO3, PS02]

Batch will be divided into groups. Each group will have maximum three students, and will perform following lab works.

The laboratory work should include the following:

A. Report of a site visit mentioning structural details with relevant sketches of structural connections.
B. Design of any **ONE** of the following structures as per IS 800- 2007
   1. Industrial building with roof supported by steel trusses (Angle sections/ Tubular Sections). Some part of building may be of G+1 system.
   2. Pedestrian steel bridge (Through type or Deck type)
C. Design of small steel building G+1 system.

For B and C above, the report should include

1. Brief Technical design project report involving: Introduction, assumptions, load calculations, analysis, detailed design.
2. Drawings: Structural plan and detailed structural drawings, on half empirical sheets or A3 size good quality paper.

References:

1. SP: 6 (1995): Handbook for Structural Engineers
2. IS 800 (2007) General Construction in Steel — Code of Practice
3. IS 808 (1989) Dimensions for Hollow Rolled Steel Beam, Column, Channel and Angle Sections
4. IS 875 (Part-I)-1997 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 1: Dead Loads — Unit Weights of Building Materials and Stored Materials (Reaffirmed 1997)
5. IS 875 (Part-II)-1987 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 2: Imposed Loads (Reaffirmed 1997)
6. IS 875 (Part-III)-1987 – Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures Part 3: Wind Loads (Reaffirmed 2003)

LC/CE 21007 ENGINEERING GEOLOGY LABORATORY

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Assignment/quiz: 40 Marks
ESE:60 Marks

Course Outcomes:

At the end of this course students will be able to:

1. Identify different types of rocks [PEO1][PO1]
2. Carry field investigations based on the identification of Igneous, Sedimentary and Metamorphic rocks. [PEO2][PO2]
3. Interpret structural geological map. [PEO1][PO1]
4. Apply the given Geological knowledge and make its effective use in various projects of Civil Engineering in Preliminary Geological Explorations, Tunnelling, Dams and Reservoirs [PEO2][PO2]
5. Carry out Geological Core Logging. [PEO1][PO1]

List of Experiments:

1. Megascopic Identification of Rock Forming Minerals (Silicates)
2. Megascopic Identification of Rock Forming Minerals (Non-Silicates)
3. Megascopic Identification of Economic Minerals. (Non-Metallic)
4. Megascopic Identification of Economic Minerals. (Metallic)
5. Megascopic Identification of Igneous Rocks. (Volcanic)
6. Megascopic Identification of Igneous Rocks. (Plutonic)
7. Megascopic Identification of Igneous Rocks. (Hypabyssal)
8. Megascopic Identification of Sedimentary Rocks. (Clastic)
9. Megascopic Identification of Sedimentary Rocks. (Non-Clastic)
10. Megascopic Identification of Metamorphic Rocks. (Foliated)
11. Megascopic Identification of Metamorphic Rocks. (NON-Foliated)
12. Practical Core Logging and Recording of Data. (preparation of Litholog/Core Log and Geological sections, interpreting geological features without drawing section, etc. based on geological data)

This is a representative list of practicals/exercises. The instructor may choose experiments as per his/her requirements (so as to cover entire contents of the course) from the list or otherwise

Detailed List-

1. **Identification of the following minerals in hand specimens:**
   Quartz and its varieties, common varieties of cryptocrystalline and amorphous silica, orthoclase, plagioclase, muscovite, biotite, zeolites, calcite, Iceland spar, Gypsum, Satinspar, fluorite, barites, tourmaline, beryl, graphite, asbestos, talc, kyanite, garnet, galena, magnetite, haematite, limonite, iron pyrites, chromite, bauxite, azurite, malachite, psilomelane.
2. **Identification of the following rock types in hand specimens:**
   Igneous Rocks
   Granites, syenites, diorites, gabbros, rhyolites, trachytes, andesites, basalts, varieties of Deccan trap rocks, volcanic breccias, pegmatites, dolerites, graphic granites.

Sedimentary Rocks
Laterites, bauxites, conglomerates, breccias, sandstones, quartzites, grits, arkose, shales, mudstone. Chemical and organic limestones.
Metamorphic Rocks
Marbles, quartzites, varieties of gneisses, slates, phyllites and varieties of schists.

3. Core Logging and preparation of Litholog/Core Log and Geological sections, interpreting geological features without drawing section, etc. based on geological data.
4. **A field visit to site of Geological work is mandatory** for gaining field knowledge of the subject and a report to be submitted as a part thereof.

Note:

ICA - The Internal Continuous Assessment shall be based on practical record andknowledge/skill acquired. The performance shall be assessed exercise wise using continuous assessment in form of assignment's/Quiz etc.
ESE -The End Semester Exam for Practical shall be based on actual Practical's performance in Laboratory and viva-voce

Reference:

1. https://nptel.ac.in/courses/105/105/105105170/

LC/CE 21008 GEOTECHNICAL ENGINEERING LABORATORY

Teaching Scheme
Practical: 2 Hrs/ week

Examination Scheme: 100 marks
Continuous Assessment - 50 marks
End Sem. Oral Exam - 50 marks

Course Outcomes:

At the end of the course, the students will be able to

1. Classify soil based on lab test. [PEO1][PO1,PSO2]
2. Select proper permeability test to determine permeability. [PEO1][PO4, PSO2]
3. Determine shear strength parameters of soil. [PEO1][PO4, PSO2], [PEO2][PO4, PSO2]
4. Determine density of soil in field. [PEO1][PO4, PSO2], [PEO2][PO4, PSO2]
5. Evaluate consolidation parameters of soil. [PEO1][PO2, PO4, PSO2],

Laboratory experiments to be conducted

1. Specific gravity determination by pycnometer / density bottle.
2. Sieve analysis, particle size determination and I. S. classification.
3. Determination of consistency limits.
4. Field density test by core cutter, sand replacement method.
5. Determination of co-efficient of permeability by constant head and by variable head method.
6. Direct shear test.
7. Standard proctor test.

8. Unconfined Compression Test
9. Demo on Triaxial Test
10. Demo on Consolidation

A Laboratory Record based on the laboratory experiments would be submitted for the term-work. Oral Examination would be based on the term work and theory covered in the class under the subject CE-21004 - GEOTECHNICAL ENGINEERING. Course Teacher for the Laboratory would decide the breakup to Oral Examination.

Reference Books:

1. IS codes: SP 36 -1
2. IS codes: SP 36-2

LC/CE 21009 TRANSPORTATION ENGINEERING LABORATORY

Teaching Scheme
Lectures: 2 Hrs/ week

Examination Scheme: 100 marks
Continuous Assessment - 50 marks
Oral Exam-based on lab work - 50 marks

Course Outcomes:

At the end of the course, the students will be able to

1. Analyze the transportation engineering materials considering practical approach. [PEO2][PO2, PSO2]
2. Evaluate the performance of transportation engineering materials [PEO2][PO4, PSO1]
3. Demonstrate various field experiments related to highway engineering [PEO2][PO2, PSO3]
4. Correlate the practical and theoretical design aspects [PEO2][PO3, PSO3]

Content:

1. Aggregate impact value
2. Los Angeles abrasion Test
3. Flakiness and elongation index
4. California Bearing Ratio Test
5. Bitumen Penetration
6. Softening Point
7. Centrifuge extraction Test
8. Flash Point & Fire point test
9. Ductility test
10. Viscosity of bitumen
11. Specific gravity of bitumen
12. Marshall stability test
13. Demonstration of Benkelman Beam Apparatus
14. Demonstration of NDT concrete test Hammer
15. Relative Viscosity of Bitumen
16. Demonstration of Core cutting and grinding machine

Note: Perform at least 10 experiments.

References:

1. MORTH "Ministry of Road Transport and Highways" -5th Revision

Honor Courses
CE(HO)21001 ADVANCED STRUCTURAL MECHANICS

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Analyse frames by displacement methods. [PEO1][PO1, PO2, PSO2], [PEO2][PO2, PSO2]
2. Analyse structures by matrix methods. [PEO1][PO1, PO2, PSO2], [PEO2][PO2, PSO2]
3. Analyse two hinged and three hinged arches. [PEO1][PO1, PO2, PSO2], [PEO2][PO2, PSO2]
4. Perform approximate analysis of multi-bay and multi-storey frames. [PEO1][PO1, PO2, PSO2], [PEO2][PO2, PSO2]
5. Analyse structures using commercial software. [PEO2][PO4, PSO2]

Unit 1 **(7 hrs)**

Analysis of indeterminate structures by displacement methods:
Slope deflection method, Moment distribution method, Applications to non-sway and sway frames

Unit 2 **(6 hrs)**

Matrix methods: Flexibility method
Application to beams and rigid jointed plane frames including rotation and settlement of supports, Application to pin jointed plane frames (trusses) including temperature change and lack of fit

Unit 3 **(10 hrs)**

Matrix methods: Stiffness method
Application to beams and rigid jointed plane frames including rotation and settlement of supports, Application to pin jointed plane frames (trusses) including temperature change and lack of fit, Member oriented stiffness method. Application to beams and rectangular portal frames

Unit 4 **(6 hrs)**

Arches:
Three hinged and two hinged parabolic and semicircular arches, Influence lines for arches, Influence lines for trusses

Unit 5 **(6 hrs)**

Approximate methods of analysis:
Portal frame method, Cantilever, Substitute frame method, Application to multi-storeyed and multi-bay rigid jointed plane frames

Unit 6 **(4 hrs)**

Use of software:
Analysis of 2D and 3D frames using commercial software

Textbooks:

1. R. C. Hibbeler, "Structural Analysis", Pearson Education Publication
2. R. C. Hibbeler (2005), "Mechanics of materials", Pearson Education Publication, 6th Edition
3. Pandit and Gupta (1999), "Theory of Structures", Vol. I, Tata McGraw Hill Publication
4. Gere and Weaver (1998), "Matrix Analysis of Framed Structures", CBS Publication Delhi, 2nd Edition

Reference Book:

1. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill Publication
2. C. K. Wang (1983),"Intermediate structural analysis", Tata McGraw Hill Publication
3. Pandit and Gupta (1997), "Structural analysis : A matrix approach", Tata McGraw Hill Publication
4. C. S. Reddy (1996), "Basic structural analysis", Tata McGraw Hill Publication, 2ndEdition

CE(HO) 21002 ADVANCED BUILDING PLANNING AND DESIGN

Teaching Scheme
Lectures: 3 Hrs/ week

Examination Scheme: 100 marks
T1 and T2 - 20 marks each
End Sem. Exam. - 60 marks

Course Outcomes:

At the end of the course, the students will be able to
1. Prepare statutory framework for Building Design. [PEO2][PO3, PSO2, PSO3]
2. Design Multifunction Public Building. [PEO2][PO3, PSO2, PSO3]
3. Design Green Building. [PEO2][PO3, PSO2, PSO3]
4. Design Intelligent Building Concept. [PEO2][PO3, PSO2, PSO3]
5. Design High Rise Building. [PEO2][PO3, PSO2, PSO3]

Unit 1 **(7 Hrs)**

Study of Statutory Framework for Building Design:
Study of National Building Code, Development Control Regulations, Byelaws pertaining to Development Activities, Restriction on development by various agencies, such as, Airport Authority of India, Archaeological Survey of India, Highway Authorities, Irrigation Department, Pollution Control Board, Coastal Regulation Zone Management Authority, Tree Authority, National Green Tribunal, etc.

Unit 2 **(7 Hrs)**

Design of Multifunction Public Building:

Study Multifunctional Public Building, Requirements of Multifunctional Public Buildings, Estimation of Parking Requirements, Mass Horizontal & Vertical Circulation, Universal Accessibility, Flexibility in Internal Design, Integrated Sanitary System, Water Supply System, Power Supply System, Fire Fighting System, Air Conditioning System, Garbage Management System, Safety and Security Measures, etc.

Unit 3 **(7 Hrs)**

Design of Green Building:
Principles and Planning Concepts of Green Buildings: salient features of a Green Building, Site Integration, Benefits of Green Buildings, Environmentally Friendly - Eco housing, Use of Insulating Materials, Energy & Water Conservation in Buildings, Storm Water Harvesting and Management, Methods of Rain Water Harvesting, Green Construction Materials, Non-Toxic Paint, Green Roofing, Economics of Green Buildings, etc.

Unit 4 **(7 Hrs)**

Intelligent Building Concept:
Introduction to Intelligent Buildings - High Performance Buildings - basic concepts of Intelligent Buildings - Intelligent Building Automation, Cost Analysis of Intelligent Buildings, Introduction to Smart Materials and Embedded Sensor Technology – Building Management System (BMS) and Energy Savings, BMS Benefits, External Skin Systems, Intelligent Flooring, Raised Floor System, etc.

Unit 5 **(6 Hrs)**

Intelligent Comfort Systems:
Introduction - HVAC System - Human Comfort - Artificial Intelligent Systems – Occupancy Sensors – Temperature Sensors; Energy Efficient HVAC Systems –Thermal Energy Storage – Under Floor Air Distribution – Chilled Beams – Other Emerging HVAC Technologies for High Performance Buildings - Automated Car Parking Management, etc.

Unit 6 **(6 Hrs)**

Planning of High-Rise Building:
Design Criteria: Design Philosophy, Classification of High Rise Building Structural System - Types - Shear Frames, Interacting Systems, Partial Tubular Systems, and Tubular Systems, Composite Steel Floor Systems, Braced Frames and Moment Resisting Frame Systems, Shear Wall Systems, Core and Outrigger Systems, Tubular Systems, Hybrid Systems, etc.

Reference Books:

1. Taranath, B. S, "Structural Analysis and Design of Tall Buildings", McGraw Hill, New York
2. Jain, V. K., Designing and Installation of Services in Building Complexes and High Rise Buildings, Khanna Publishers, New Delhi.
3. Gupta, Y. P., High Rise Structures, Design and Constructions Practices for Middle Level Cities, New Age International Publishers, New Delhi
4. Bryan Stafford Smith & Alexcoull, "Tall Building Structures Analysis and Design", John Wiley
5. Hojjat Adeli and Amgad Saleh, "Control Optimization and Smart Structures: High Performance Bridges and Buildings of the Future", John Wiley, New York.
6. Schwartz, Mel, Smart Materials, CRC Press, Boca Raton.
7. Bennetts, Ian etal - Tall Building Structural Systems
8. Proceedings of the Council for Tall buildings - Vol. 1 to 10
9. National Building Code.
10. Kibert C. J., "Sustainable Construction: Green Building Design and Delivery", 2nd Ed., John Wiley, Hoboken, New Jersey
11. Miller, G. T. Jr., "Living in the Environment: Principles, Connections, and Solutions", 14th Ed., Brooks Cole, Pacific Grove, California

CE(HO) 21003 LAND AND WATER MANAGEMENT ENGINEERING

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme:100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Demonstrate the knowledge of hydrology, irrigation, soil and water conservation and watershed management [PEO1][PO1]
2. Identify and implement suitable method of land and water management. [PEO1][PO1]
3. Design soil and water conservation structures [PEO2][PO3, PSO3]
4. Estimate soil erosion and water requirements of crops [PEO2][PO3, PSO3]
5. Design pressurized irrigation systems and surface and subsurface drainage system [PEO2][PO3, PSO3]

Unit 1 **(7 hrs)**

Introduction: Basic concepts in Hydrology and Irrigation:
Components of the hydrologic cycle. precipitation, rainfall, depth, intensity and duration of rainfall, effective rainfall, runoff, factors affecting runoff, Infiltration, evaporation, transpiration, Evapo-transpiration (ET), Crop water requirements, plant indices and climatic parameters and critical stages of crop growth in relation to irrigation. Irrigation scheduling, plant water relations, concept of plant water potential. Development of crop water deficit,

crop adaptation to water deficit, morpho-physiological effect of water deficit, Management strategies to improve crop productivity under limited water supplies.

Unit 2 **(7 hrs)**

Soil and Plant:
Soil and water as important resources for agricultural production, water retention by soil, soil moisture characteristics, field capacity, permanent wilting point, soil irritability classifications, factors affecting profile water storage. Soil water depletion, soil water potential and its components, hydraulic head. Field water budget, water gains and water losses from soil, deep percolation beyond root zone, capillary rise

Unit 3 **(7 hrs)**

Soil and Water Conservation:
Soil erosion, types of erosion, soil loss measurement and estimation, Universal soil loss equation and subsequent its modifications, soil and water conservation structures and their design. Gully control structures and their design. Design and construction of farm pond and reservoir. Application of GIS in soil and water conservation.

Unit 4 **(7 hrs)**

Watershed Management:
Watershed concept, Identification and characterization of watersheds. Hydrological and geomorphological characteristics of watersheds. Land capability classification and soil maps. Principles of watershed management, development of watershed management, its feasibility and economic evaluation

Unit 5 **(7 hrs)**

Irrigation Water Management:
Methods of irrigation, surface methods, overhead methods, pressurized irrigation system such as drip and sprinkler irrigation. Merits and demerits of various methods. Hydraulics of furrow, check basin and border irrigation, Hydraulics and design of pressurized irrigation systems. Irrigation efficiency and economics of different irrigation systems. Quality of irrigation water and irrigation with poor quality water. Farm water management, socio-economic aspects of farm water management. Scope for economizing the use of water

Unit 6 **(7 hrs)**

Management of Degraded and Waterlogged Soils:
Excess salt and salt tolerant crops, hydrological imbalances and their corrective measures. Concept of critical water table depths for crop growth, agricultural field drainage and theory of flow in saturated soil. Drainage investigations and drainage characteristics of different soils, drainage coefficient. Design and installation of surface and subsurface drainage system. Drainage requirements of crops, drainage in relation to salinity and water table control. Salt-affected soils and their reclamation, Command area development organizational structures and activities. Irrigation water users' association concept and responsibilities.

Textbooks:

1. Murthy, V.V.N. (1999) "Land and Water Management Engineering", Kalyani Publishers, Ludhiana

Reference Book:

1. Schwab G.O., Fangmeier, D.D. and Elliot W.J. (1996), "Soil and Water Management Systems", John Wiley and Sons, New York
2. Suresh, R.L. (1999), "Soil and Water Conservation Engineering", Standard Publishing Co. Delhi.
3. Michael, B.A. M. (1990) "Irrigation", Vikas Publishing House Pvt. Ltd. N Delhi.
4. Asawa, G.L. (1996) "Irrigation Engineering", New Age International Pub. Co. N Delhi.

Minor Course

CE(MI) 21001 CONSTRUCTION MATERIALS AND BUILDING DESIGN

Teaching Scheme
Lectures: 3hrs/week

Examination Scheme:100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

At the end of the course, the students is able to

1. Select suitable qualities of stone and bricks for use as building materials. [PEO1][PO1, PO2, PSO1, PSO2]
2. Select suitable qualities of doors and windows for use in buildings. [PEO1][PO1, PO2, PSO1, PSO2]
3. Select suitable qualities of flooring and roofing materials for use in buildings. [PEO1][PO1, PO2, PSO1, PSO2]
4. Demonstrate properties of different materials. [PEO1][PO1, PSO1, PSO2]
5. Apply various principles of building planning. [PEO1][PO1, PO3, PSO1, PSO2]
6. Plan ventilation and lighting requirements of a building. [PEO1][PO1, PO3, PSO1, PSO2]

Unit 1 **(6 hrs)**

Building materials:
Stones : Stones Requirements of good building stones, IS specification and tests on stones; stone masonry, Brick masonry, Characteristics of good building bricks, IS specifications and test; Classification of bricks

Unit 2 **(6 hrs)**

Materials for Doors and windows:
Functional requirements, materials of doors and windows, glazing, method of fixing doors windows, fixtures and fastenings. Timber Types and properties, seasoning, testing; Glass – Types and properties.

Unit 3 **(7 hrs)**

Flooring and Roof material:
Flooring materials, tests and IS specifications: Ground and upper floors; functional requirements of flooring material, varieties of floor finishes and their suitability.
Roofing materials: GI, AC, fibre sheets, Mangalore tiles; Roof construction – types and their suitability.

Unit 4 **(6 hrs)**

Miscellaneous materials:
Properties, types and uses of following materials, Lime, Ferrous metals, Polymers, Plastics types, Mastic, Gypsum, Ferro Crete, Clay Tiles and glazed ware, Plaster of Paris. Artificial stone; Aluminium and alloys – Properties.

Unit 5 **(8 hrs)**

Building planning:
Principle of Building planning, Integrated approach in Built Environment, Building Rules and Byelaws, Necessity of laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), marginal distance, building line control line, height regulation, Built-up area, floor area, carpet area, Landscape elements and elements of interior decoration.

Unit 6 **(6 hrs)**

Building Design:
Introduction, Types of load, thermal insulation of roofs and walls. Ventilation: Necessity of ventilation, stack effect, wind effect, Mechanical ventilation, objectives, selection of ventilation system, ventilation rate, Lighting: Principles, Day lighting, design of windows, sky component, E.R.C, Orientation, artificial illumination, supplementary illumination

Textbooks:

1. Shah M. G., Kale C. M. and Patki S. Y., "Building drawing an Integrated approach to Built environment", Tata McGraw Hill (Fifth edition).
2. Mentt, "Building Design and Constructions", Tata McGraw Hill (Second edition)

Reference Book:

1. National Building Code of India 2016, Bureau of Indian Standard, New Delhi
2. Ghosh, "Materials of Construction" Tata McGraw Hill
3. M. S. Mamlouk and J. P. Zaniewski, Materials for Civil and Construction Engineers, 3rd Ed., Prentice Hall, USA, 2010.
4. P. C. Varghese, Building Materials, PHI Learning Pvt. Ltd., India, 2005.
5. TTTI Chandigrah, "Civil Engineering Materials", Tata McGraw Publication

SEMESTER VI

BSC/MA21002 PROBABILITY AND STATISTICS FOR ENGINEERS

Teaching Scheme
Lectures: 3 hrs/ week
Tutorial: 1 Hr/ week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Learn a number of methods of summarizing and visualizing data sets, compute probabilities of events. [PEO1][PO1, PO2, PO4]
2. Use the concepts of random variables and associated probability distributions, understand the meaning of central limit theorem. [PEO1][PO1, PO2, PO4]
3. Do basic statistical inference (t-test, z-test, F-test, χ^2–test, confidence interval). [PEO1][PO1, PO2, PO4]
4. Do basic regression analysis. [PEO1][PO1, PO2, PO4]
5. Demonstrate use of R software for all the above. [PEO1][PO1, PO2, PO4]

Unit 1 **(5 hrs)**

Descriptive statistics:
Measures of location and variation. Visualization of data: Frequency tables, bar diagrams, histograms, heat maps, other visualization tools, Review on introduction to combinatorics and probability theory

Unit 2 **(5 hrs)**

Some of the basic probability distributions:
Binomial, Poisson, Exponential, and Normal. Central limit theorem.

Unit 3 **(4 hrs)**

Introduction to 'R':
Introductory R language fundamentals and basic syntax, major R data structures, Using R to perform data analysis, creating visualizations using R

Unit 4 **(6 hrs)**

Basic statistical inference and hypothesis testing:
Estimation, basic tests such as t-test, z-test, F-test, χ^2 -test.

Unit 5 **(4 hrs)**

Regression methods:
Simple linear regression and multiple regression

Unit 6 **(4 hrs)**

Engineering applications of statistics:
Discussion on reliability and quality control, Introduction to random processes, stochastic processes, Markov chains

Textbooks:

1. Ronald E, Walpole, Sharon L. Myers, Keying Ye, Probability and Statistics for Engineers and Scientists (8th Edition), Pearson Prentice Hall, 2007
2. Ross S.M., Introduction to probability and statistics for Engineers and Scientists (8th Edition), Elsevier Academic press, 2014

Reference Book:

1. S. P. Gupta, Statistical Methods, S. Chand & Sons, 37th revised edition, 2008
2. Morrison S.J., Statistics for Engineers - An introduction, Latest edition, 2009
3. William W. Hines, Douglas C. Montgomery, David M. Goldsman, Probability and Statistics for Engineering, (4th Edition), Wiley Student edition, 2006
4. Kishor S. Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications (2nd Edition), Wiley Student edition, 2008
5. Stephens L.J., Schaum's outline of statistics for Engineers, Latest edition, 2019
6. The practice of Business Statistics by Manish Sharma and Amit Gupta, Khanna Publishing Company Private Limited, New Delhi, 2014

MLC/ML21001 CONSTITUTION OF INDIA

Teaching Scheme
Lectures: 1 hr / week

Examination scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

At the end of the course, student will demonstrate the ability to:

1. Interpret the Preamble and know the basics of governance of our nation. [PEO3][PO6, PO8]
2. Identify the different aspects covered under the different important Articles. [PEO3][PO6, PO8]
3. Apprehend the basic law, its interpretation and the important amendments. [PEO3][PO6, PO8]
4. Understand our Union and State Executive better. [PEO3][PO6, PO8]
5. Recognize the basic that along with enjoying the rights one needs to fulfil one's duties. [PEO3][PO6, PO8]
6. Summarize and Gain confidence on our Constitution by knowing it better. [PEO3][PO6, PO8]

Unit 1 **(5 hrs)**

Understanding the concept 'Rule of Law'
Meaning and history of Constitution.
Introduction to The Constitution of India, understanding its objects.
Preamble to the constitution of India

Unit 2 **(4 hrs)**

Understanding the concept of Human Rights and Fundamental Rights.
Fundamental rights under Part – III, exercise of the Rights, limitations and important cases.
Prerogative Writs.
Fundamental duties & their significance.

Unit 3 **(4 hrs)**

Relevance of Directive principles of State Policy.
Legislative, Executive & Judiciary (Union and State)
Constitutional Provisions for Scheduled Castes, Scheduled Tribes, & Backward classes.
Constitutional Provisions for Women & Children

Unit 4 **(2 hrs)**

Emergency Provisions.
Electoral procedure in India
Amendment procedure and few important Constitutional Amendments

Textbooks:

1. Introduction to the Constitution of India by Durga Das Basu (Students Edn.) Prentice – Hall EEE, 19th/20th Edn.
2. Engineering Ethics by Charles E. Haries, Michael. S. Pritchard and Michael J. Robins Thompson Asia.

Reference Book:

1. An Introduction to Constitution of India by M.V. Pylee, Vikas Publishing

Humanities and Social Sciences Open Courses-I

HSSC/AS(HS)21001 ENGLISH PROFICIENCY LANGUAGE

Teaching Scheme **Examination scheme:**100 marks

Lectures: 2 hrs/week T1 and T2 - 60 Marks each
End Sem. Exam. - 40 Marks

Course Outcomes:

At the end of the course, student will demonstrate the ability to:

1. Understand concepts of English language and apply them practically. [PEO3][PO10]
2. Reproduce meaningful and well-structured sentences for conversation or speech in English. [PEO3][PO10]
3. Analyze, comprehend and write well and effectively produce enhanced formal communication in English. [PEO3][PO10]
4. Display their Presentation skills and participate and produce healthy discussions both formally and informally among peers using English. [PEO3][PO10]
5. Create impact by acquiring professional skills, confidently face interviews and be better employable and industry ready. [PEO3][PO10]

Unit 1 **(8 Hrs)**

English for communication:
Basic understanding of language and its need for effective business communication for Engineers, Formal and informal expressions, Vocabulary Building, Business Idioms

Unit 2 **(6 Hrs)**

Presentation Skill Development:
Oral Presentations, Basic Mannerisms and Grooming required for professionals, Cross cultural communication, Business Etiquette

Unit 3 **(8 Hrs)**

Business Writing:
Writing Mechanics, Note making, Summarizing, Letter &Email Writing, Business Reports, Statement of Purpose

Unit 4 **(6 Hrs)**

Employability Enhancement:
Job Readiness, Interview Skills and Mock Interviews

Reference books:

1. Business Communication by Shalini Verma (2nd Edition) (Vikas Publishing House)
2. Communication for Business: A Practical Approach by Shirley Tailor (Longman)
3. Communication Skills for Engineers by S. Mishra & C. Muralikrishna (Pearson)
4. Communication Skills for Technical Students by T.M. Farhathullah (Orient Longman)
5. Enhancing Employability at Soft Skills by Shalini Varma (Pearson)

6. Written Communication in English by Saran Freeman (Orient Longman)
7. Corporate Communication by Jaishri Jethwaney (Oxford University Press)
8. Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill)
9. Essential English Grammar (Intermediate & Advanced) Raymond Murphy (CUP)

HSSC/AS(HS)21002 GERMAN LANGUAGE

Teaching Scheme
Lectures: 2 hrs/week

Examination Scheme: 100 marks
Assignments - 40 Marks
End Sem. Exam. - 60 Marks

Course Outcomes:

At the end of the course, student will demonstrate the ability to:

1. Acquire knowledge of facts about Germany and German culture (cultural sensitization). [PEO3][PO10]
2. Adapt pronunciation of German letters and greetings. [PEO3][PO10]
3. Identify and calculate numerical till 1000. [PEO3][PO10]
4. Describe themselves and third person. [PEO3][PO10]
5. Construct simple questions or sentences and interact with the teacher and classmates. [PEO3][PO10]
6. Comprehend time and time related phrases, illustration of the same in conversations. [PEO3][PO10]
7. Handle day to day situations like placing an order in the restaurant or interact with shopkeeper in the supermarket. [PEO3][PO10]

Unit 1 **(6 Hrs)**

Guten Tag! (Good day):
Greetings, self introduction and partner introduction, numbers till 100, how to mention telephone number and email address, about countries, nationalities and languages.

Unit 2 **(6 Hrs)**

Freunde, Kollegen und ich (Friends, colleagues and myself):
Hobbys, days of the week, months, seasons and professions, classroom objects and classroom communication

Unit 3 **(6 Hrs)**

Dining out:
Understanding German cusine, meal courses, names of the ingredients, conversation with the waiter and in the supermarket.

Unit 4 **(6 Hrs)**

Uhrzeit (Timing):
Mention time, daily routine, making appointments

Unit 5 **(6 Hrs)**

Grammatik (grammar):
Vocab, Verb conjugations, WH-question, verbs, pronounciation, personal pronouns, articles, Singular and Plural, negation.

Reference Books:

1. Dengler. S., Rusch. P., Schmitz. S., & Sieber. T. Netzwerk, Deutsch als Fremdsprache. 2015. Goyal Publishers & Distributors Pvt. Ltd. Delhi, India
2. You tube video series "learn German", "easy German" etc.
3. Funk. H., Kuhn. C., & Demme. S. Studio d A1. Deutsch als Fremdsprache. 2011. Goyal Publishers & Distributors Pvt. Ltd. Delhi, India.

HSSC/AS(HS)21003 JAPANESE LANGUAGE

Teaching Scheme
Lectures: 2 hrs/week

Examination Scheme: 100 marks
Assignment - 40 Marks
End Sem. Exam. - 60 Marks

Course Outcomes:

At the end of the course, student will demonstrate the ability to:
1. Acquire knowledge of facts about Japan and Japanese culture. [PEO3][PO10]
2. Familiarize with pronunciation of Japanese letters and daily greetings, Accent, Intonation and Japanese writing System Hiragana, Katakana and Kanji. [PEO3][PO10]
3. Identify numbers, Colours, Years, Months and Days, Time expressions, Directions to read the city map. [PEO3][PO10]
4. Describe themselves and third person and family members. [PEO3][PO10]
5. Construct simple questions or sentences and interact with the teacher and classmates. [PEO3][PO10]
6. Apply Engineering Terminology and Japanese work culture such as Monozukuri, 5S, Kaizen, 3M, 5W1H etc. [PEO3][PO10]

Unit 1 **(6 Hrs)**

Introduction to Japanese Language (Nihongo):
Recognize Japanese Characters Hiragana. Can read /write Hiragana script
Use basic classroom expressions
Exchange greetings Can thank someone or apologize someone
Recognize Japanese Characters Katakana Can read /write Katakana script
Can ask someone to say something again if you don't really understand

About Me & Food:
Give simple self introduction Can ask and answer where you live and your age.
Can write your name, nationality, date of birth and occupation in Japanese.
Recognize the parts of a business card
Talk someone briefly about your family using a family photo and answer simple questions such as who is that? Number of family members.
Talk about your favourite foods you like and dislike. Talk about your breakfast.
Can respond when offered a drink? For example saying what you want to drink.
Can look at menu in a fast food restaurant and understand what is available.
Can look at different restaurants' signboards and understand what each place is.

Unit 2 **(6 Hrs)**

Home & Daily life:
Say what kind of house you live in. Say what you have in your home.
Write an e mail inviting someone to your home. Visit/ Welcome a friend.
Ask /say where to put things in the room. Can read the buttons on an electric appliance
Can listen to a simple explanation when being shown around a room and understand the layout.
Recognize the name and address on signs. Talk about your daily routine. Say the time you do something. Talk about your schedule at work for the week.
Can listen to short and simple instructions at work and understand what to do.
Can read a simple, handwritten note at work and understand the instructions.
Can ask someone to lend you something at work?
Can look at a list of equipment and confirm if you have all the items.

Unit 3 **(7 Hrs)**

Holidays and Days off 1 and Towns:
Can give a simple answer when asked about your hobbies and favourite things to do.
Talk about what you do on your days off.
Can read an event poster and find the important information such as the date, time and place.
Can ask and answer questions about whether you are going to an event etc.
Can say when you are available, when you are inviting someone to something or being invited
Recognize station and Taxi signs.
How to get to particular destination using a map
Can say how you go to work and how long it takes.
Describe places in town and location
Can look at common signs in a station and understand what they mean.

Unit 4 **(6 Hrs)**

Shopping & Holidays and Days off 2:
Talk about what you want to buy.
Can ask staff in a shopping center etc. Where to go for a certain item and understand the answer.
Can look at discount signs and read the prices.
Make a brief comment on things in a shop.

Can read a short blog / simple e mail
Can talk in simple terms about impressions of the holiday / trip.
Can write a simple post for social media etc. About what you did in holiday.

References Books:

1. Marugoto A1 Katsudo Starter Course book for Communicative Language Activities.
2. Marugoto A1 Rikai Starter Course book for Communicative Language Competences
3. The Japan Foundation
4. Minna no Nihongo Main Textbook Elementary Lesson 1-12
5. Minna no Nihongo Translation & grammatical Notes in English Elementary Lesson 1-12,3A Corporation Goyal Publishers

HSSC/AS(HS)21004 SPANISH LANGUAGE

Teaching scheme
Lectures:2 hrs/week

Examination scheme: 100 marks
Assignments - 40 Marks
End Semester - 60 Marks

Course Outcomes:

At the end of the course, student will demonstrate the ability to:

1. Acquire knowledge of facts about Spain and Latin Americaand Spanish culture, pronunciation of Spanish letters and greetings. [PEO3][PO10]
2. Identify and calculate numerical till 1000. [PEO3][PO10]
3. Describe themselves and third person. [PEO3][PO10]
4. Construct simple questions or sentences and interact with the teacher and classmates. [PEO3][PO10]
5. Comprehend time and time related phrases, illustration of the same in conversations. [PEO3][PO10]
6. Handle day to day situations like placing an order in the restaurant or interact with shopkeeper in the supermarket. [PEO3][PO10]

Unit 1 **(6 Hrs)**

Hola! (Hello):
Greetings, self introduction and partner introduction, numbers till 100, how to mention telephone number and email address, about countries, nationalities and languages. Hobbys, days of the week, months, seasons and professions, classroom objects and classroom communication.

Unit 2 **(6 Hrs)**

La comida (Food):
Understanding Spanish cusine, meal courses, names of the ingredients, converstaion with the waiter and in the supermarket.

Unit 3 **(6 Hrs)**

La ropa (clothing):
Clothing, accessory (as per weather), season + weather, vocabulary, Demonstrative pronouns, how to ask about price, numbers till 1000.

Unit 4 **(6 Hrs)**

La hora (Timing):
Mention time, daily routine, making appointments

Unit 5 **(6 Hrs)**

La gramática (grammar):
Vocab, Verb conjugations, WH-question, verbs, pronounciation, personal pronouns, articles, Singular und Plural, negation.

Reference Books:

1. Aula internacional 1Jaime Corpas, Eva García, Agustín Garmendia, Neus Sans Baulenas (contributor), published by Goyal Publisher's and Distributors Pvt. Ltd.

HSSC/HS21001 ENTREPRENEURSHIP PRINCIPLES AND PROCESS

Teaching Scheme
Lectures: 1 hr / week

Examination Scheme: 100 marks
Field work and Assignment - 40 Marks
End Sem. Exam. - 60 Marks

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Discover, develop, and assess different types of Entrepreneurial ventures and opportunities. [PEO3][PO11, PO12]
2. Learn about opportunity and risk analysis. [PEO3][PO11, PO12]
3. Use the strategies for valuing your own company, and how venture capitalist and angel investors use valuations in negotiating milestones, influence and control. [PEO3][PO11, PO12]
4. Pick correct marketing mix and how to position the company in the market by using analytical tools. [PEO3][PO11, PO12]
5. Learn how to sale themselves and the product/service and to handle objections. [PEO3][PO11, PO12]
6. Know how organizations operates, their process matrices, start new ventures, write winning business plans. [PEO3][PO11, PO12]

Unit 1 **(3 hrs)**

Market Research, Types of Companies and Organizations:
Introduction to Entrepreneurship, Profile of the Entrepreneur, Market Gap /Opportunity

Analysis, Market Research Methods, Defining the Focal Market: Market Segmentation, Industry analyzing– Research /Competitive Analysis. Company/ Organization Types, Legal Aspects, Taxation, Government Liaison, Building the Team, Mergers and Acquisitions

Unit 2 **(4 hrs)**

Business Finance, Marketing & Digital Marketing:
Shares and Stakes, Valuation, Finance Creation (Investors/Financers), Revenue Plans and Projections, Financial Ratios, Business Lifecycle, Break Even. Marketing Basics, Marketing Strategy and Brand Positioning, Plans and Execution Techniques, Marketing Analytics, Online Marketing

Unit 3 **(3 hrs)**

Sales & Operations Management:
Understanding Sales, Pitching Techniques, Sales strategies, Inside Sales v/s Outside Sales, RF
Operational Basics, Process Analysis, Productivity, Quality

Unit 4 **(2 hrs)**

Start-ups:
Start-up Basics, Terms, Start-up Financing, Start-up Incubation, Start-up Incubation, Getting Listed

Text Books:

1. The Startup Play book : Secrets of the Fastest-Growing Startups From Their Founding Entrepreneurs by David Kidder
2. True North by Bill George and Peter Sims
3. Cardullo, M.W.P.E. (1999).Technological entrepreneurism : Enterprise formation, financing, and growyh. England: Research Studies Press Ltd.

References:

1. Kanungo, R.N.(1998). Entrepreneurship and innovation : Models for development (Ed.,Vol.2). New Delhi: Sage.
2. Van Nostrand. Verma, J.C. & Singh, G.(2002). Small business and industry: A hand book for entrepreneurs. New Delhi : Response-Sage.
3. Richard A Brealy & Steward C Myres. Principles of Corporate Finance, McGraw Hills 7th Edn., 2004
4. Prasanna Chandra, Financial Management :Theory and Practice, Tata McGraw Hills, 6th Edn., 2004 I M Pandey, Financial Management, Vikas Publishing

SBC/CE21010 MINI PROJECT: DESIGN SIMULATE PROTOTYPE AND TEST [DSPT] PHYSICAL MODELS IN CIVIL ENGINEERING

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Prepare conceptual drawing/sketch of a model for the actual preparation of physical models based on the topics related to Civil Engineering. [PEO1][PO1, PO2, PO5], [PEO2][PO2, PO4, PO5]
2. Fabricate/Construct actual physical model/ working model. [PEO2][PO2, PO4, PO5, PSO2]
3. Demonstrate usefulness of the model by describing/ experimenting /future scope for further development. [PEO1][PO1, PO2, PO5], [PEO2][PO2, PO4, PO5, PSO2]

There will be groups of students - consisting of 8 to 10 students in a group. Each group will be given a task of design of a physical model of a structures/ schemes/ concepts/ principles in Civil Engineering.

Unit 1 **(4 hrs)**

Introduction to model making:
Introduction-Types of models, Importance of physical models in Engineering, Different types of structures in Civil Engineering, scope and limitations for the preparation of physical models in Civil Engineering

Unit 2 **(4 hrs)**

Deciding a Model:
Literature Survey and observations for the requirements of models, Selection of structures/ principles/ concepts in Civil Engineering for the preparation of physical models Listing out factors to be considered for making the physical model. Deciding the scope of the physical model.

Unit 3 **(4 hrs)**

Working on a Model:
Selection of the materials for the model. Preparation of the conceptual drawing for the preparation of the physical model. Preparation of final draft, drawing for the physical model, rough estimate and approval for the same.

Unit 4 **(4 hrs)**

Design/fabrication of Physical Model:
Deciding suitable location/ field, Interaction with other laboratories, workshop, skilled workers/ industry

Unit 5 **(4 hrs)**

Demonstration/ Checking/ testing of model and suggestions for correction/ further development:
Depending on the type of model presentation/demonstration, discussion on the possible improvement

Unit 6 **(4 hrs)**

Presentation/Exhibition/Examination of Models:
Each student will present/ demonstrate his contribution for developing a model. Assessment will be done by a group of Faculty/ industry people.

References:

1. W. B. Mckay, "Building Construction- Vol. I" Fifth Edn., Orient Longman Ltd London, 1995
2. Alireza Behnejad, "Benefits of Full-scale Physical Models in Civil Engineering Education" Conference Paper, June 2016 available on researchgate.net
3. Any other relevant literature to be searched suitable for the given mode

IOC/CE21017 IOC - I Geoinformatics and Applications

Teaching Scheme
Lectures: 2 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:
1. Gain fundamental understanding of the RS, GIS,GPS technologies
   [PEO1][PO1,PO2], [PEO2][PO2, PO4, PO5]
2. Become familiar with the GIS-based analytical and problem-solving techniques
   [PEO1][PO4, PO5], [PEO2][PO2, PO4, PO5]
3. Know various applications in systems engineering.
   [PEO1][PO1, PO4, PO5], [PEO2][PO2, PO4, PO5, PSO3]

Unit 1: (**5 hrs)**
Fundamentals of Geoinformatics (RS -GIS -GPS) Geospatial technology. Scope and status. Various tools. Overview of applications

Uni-2: (**5 hrs)**
Fundamental of Remote Sensing. Electromagnetic spectrum. Types of Remote Sensing, Components of Data acquisition system. Platforms Cameras and sensor parameters. Elements of satellite images. Concept of bands, pixel, digital number, metadata. Multispectral Remote Sensing. Microwave and Thermal bands, Combination of bands, False colour composite, Digital image processing, NDVI, Classifications, Ground truth.

Unit-3: (**5 hrs)**

Introduction to GIS. Components of GIS. Hardware and Software GIS functionality. Data capture. Point, line, polygon. Vector and Raster data, Projections and Geo referencing. Layers and attributes. Union, Intersection Buffer, Merge and Clip analysis. Proximity and overlay analysis.

Unit-4: (**5 hrs)**

Introduction to GPS, Components of GPS systems. Fundamental concepts. Coordinates and reference systems Projections. Land navigation and Survey reconnaissance. Differential GPS. National GPS applications.

Unit-5: **(10 hrs)**

GIS software Packages. Practice exercises. Various applications in systems/water resources engineering

References:

1. Remote Sensing and Image Interpretation by Thomas M. Lillesand, Ralph W. Kiefer , Jonathan W. Chipman
2. Geographic Information Systems and Environmental Modelling by Clarke, Keith C., Bradley O. Parks, and Michael P. Crane. Upper Saddle River, NJ: Prentice Hall, 2002.
3. Principles of Remote Sensing- Edition: ITC Educational Textbook Series 2,Publisher: ITC, nschede Editors: N. Kerle, L.L.F. Janssen, G.C. Huurneman

DEC/CE(DE) 21001 ADVANCED SURVEYING

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Use advanced instruments for surveying. [PEO3][PO5, PSO1]
2. Make survey for large area. [PEO3][PO5, PSO1]
3. Apply corrections to field data. [PEO3][PO5, PSO1]
4. Analyze data on software. [PEO2][PO4, PO5, PSO1, PSO3]

Unit 1 **(7 hrs)**

Triangulation Adjustment:

Kinds of errors, Laws of weights, Determination of Most probable values [MPV] of conditioned and independent quantities, Method of least squares, probable error and its determination, Distribution of error to the field measurement. Normal equation, Method of correlates, station adjustment and figure adjustment of Geodetic triangle [without central station] and Geodetic Quadrilateral [without central station], Spherical triangle, calculations of spherical excess and sides of spherical triangle.

Unit 2 **(7 hrs)**

Hydro-graphic Surveying:
Objects, Establishing controls, Shoreline survey, soundings, Equipments for measuring soundings and method of locating soundings, Reduction of soundings, Plotting of soundings, Three point problem and its solution by Analytical and Graphical methods. Tides and tide gauges, Nautical sextant and its use.

Unit 3 **(7 hrs)**

Remote Sensing:
Basic principles, Electromagnetic spectrum, Interaction mechanism and image formation, Classification of remote sensing systems, platforms for sensing different types of data products, Applications to Civil Engineering, concept of global positioning systems [GPS] and differential GPS.

Unit 4 **(7 hrs)**

GIS:
Components of GIS- data acquisition, spatial and attribute data, pre-processing, storage and management; Data structures- raster and vector data; GIS analysis functions; Errors and corrections; Data presentation and generation of thematic maps; Applications.

Unit 5 **(6 hrs)**

GPS:
Detailed discussion on various generations of GPS satellites, trilateration techniques, GPS signals, anti-spoofing, concept of standalone positioning and GNSS receivers.

Unit 6 **(6 hrs)**

Modern Surveying Instruments:
Electromagnetic waves and their properties, phase, phase comparison, Modulation, Types of Electromagnetic Distance Meters [E.D.M.]–Geodimeter, Tellurometer, Distomat. Total Station and its uses.

Text Books:

1. T. P. Kanetkar & S. V. Kulkarni, "Surveying and Leveling Vol. II", Pune Vidhyarthi Gruha.
2. Dr. B.C. Punmia, "Surveying Vol. II & III", Laxmi Publications (P) Ltd., New Delhi.
3. Dr. K. R. Arora ,"Text book in Surveying Vol. II & II", McMillan Publication

Reference Books:

1. J. Uren and W. F. Price, "Surveying for Engineer", McMillan Publication.
2. Anderson, "Introduction to Surveying", McGraw Hill Publication.
3. Paul R Wolf, "Elements of Photogrammetry", McGraw Hill Publication.
4. J. M. Kennie and M. C. Matthews, "Remote Sensing in Civil Engineering", McGraw Hill Publications.

DEC/CE(DE) 21002 DESIGN OF HYDRAULIC STRUCTURES

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Demonstrate different terminologies related to hydraulic structures. [PEO1][PO1, PSO1]
2. Select suitable hydraulic structure in a particular situation. [PEO1][PO1, PSO1]
3. Compute the trial section of gravity dam, earthen dam, spillways, weirs, barrages and apply stability checks. [PEO1][PO3, PSO2]
4. Assess hydropower potential and river training works. [PEO1][PO1, PSO1]
5. Select and design suitable canal, piped distribution network and stable channel in Alluviums. [PEO1][PO3], [PEO2][PSO2]

Unit 1 **(7 hrs)**

Introduction:
Dam, types of dam, selection of dam, various components of dam, gravity dam details: joints, water-seals and galleries. Elements of earthen dam, basic design consideration, design of section, design of filters, rock toe, pitching, causes of failures, piping and its prevention.

Unit 2 **(7 hrs)**

Canal Irrigation and Piped Distribution Network:
Types of canal, canal alignment, losses in irrigation channel, various types of canal lining, economics of lining, determination of canal capacity, design of lined channels, piped irrigation network, advantages, disadvantages, application of piped irrigation network, data required for piped irrigation network, hydraulics of pipe flow, design standards of pipe irrigation network, piped irrigation network design

Unit 3 **(6 hrs)**

Spillway And Gates:
Spillway capacity, flood absorption and disposal, different types of spillway, their principles of design and construction, energy dissipation below overflow spillway, types and uses, gates.

Unit 4 **(6 hrs)**

Diversion Head Works:
Diversion head works, selection of sites, layout of the work types of weirs and barrages, safety against piping and uplift, Bligh, Lane, and Khosala's Theories, design of weirs on permeable foundations.

Unit 5 **(7 hrs)**

Preliminary Sediment Transport Theory and Canal Masonry Works:
Critical tractive force, regimes of flow, resistance of bed forms, suspended and bed load, its effect on channel design. Design of stable channels in alluvium, the regime method, Semi theoretical approach, cross-section of irrigation channels. Cross drainage works, necessity types and selection, comparative merits and demerits, principles of design of various types of cross drainage work, canal falls and its types.

Unit 6 **(7 hrs)**

River Training Works and Hydro Power:
Hydraulics of alluvial rivers, meandering, aggradations and degradation, river training, necessity, river training works and bank protection, various measures and their design and construction principles. General features of Hydro-power, Principal components of a hydropower station: Intakes and Trash racks, Water conductor system, Tunnels, Surge tanks, Penstocks, Anchor blocks. Types of development, general layouts of different types, Assessment of power potential, cavitation.

Text Books:

1. Asawa G. L., Irrigation and Water Resources Engineering, New Age International (P) Ltd. Publishers, 2014
2. Garg, S. K., Irrigation Engineering and Hydraulic Structures, Vol. I and II, Khanna Publishers Delhi, Tenth Edition 2010
3. Modi, P.N., Irrigation, Water Resource and Water Power Engineering, Standard Book House, Delhi, Ninth Edition 2014.

Reference Books:

1. River Behaviour, Management and Training, CBIP Vol. I, 1989
2. Varshney R. S., Concrete Dams, Oxford and IBH Publishing Co.
3. Goldin, A. L. and Rasskazor, L. N., Design of Earth Dams, CRC Press (1992).
4. Guidelines for Planning and Design of Piped Irrigation Network, Ministry of Water Resources, Government of India, July 2017

DEC/CE(DE) 21003 FOUNDATION ENGINEERING

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

At the end of the course, the students will be able to

1. Plan proper soil exploration program for the given condition of soil and structure. [PEO1][PO1, PO5, PSO2]
2. Select suitable types of foundation required for a structure according to the soil conditions. [PEO2][PO3, PO4, PSO2]
3. Calculate Bearing capacity of the soil. [PEO1][PO1, PO3, PO5, PSO2], [PEO2][PO2, PO3, PSO2]

4. Compute the safe pressure of soil from settlement point of view. [PEO1][PO1, PO5, PSO2], [PEO2][PO2, PO4, PO5, PSO2]
5. Calculate area required for a shallow Foundation. [PEO2][PO2, PSO2]
6. Design dimensions and length of pile foundation. [PEO2][PO2, PO3, PO4, PSO2]

Unit 1 **(6 hrs)**

Soil Exploration:
Purpose, importance, methods of soil exploration, subsurface exploration, trial pits, boring: method of borings. Number of boreholes, depth and spacing of boreholes, types of test to suit the soil conditions, Location of water table, Sampling: Disturbed and Undisturbed Samples, Field tests: SPT, DCPT, SCPT, pressure-meter test, plate load test, field vane shear test

Unit 2 **(6 hrs)**

Introduction to Foundation Engineering:
Functions of substructure, Common Types of foundations viz. shallow and deep foundations, isolated and combined footings, raft, pile, well foundations, suitability and applications. Minimum depth of footing.

Unit 3 **(7 hrs)**

Bearing Capacity of Shallow Foundation:
Terzaghi's bearing capacity analysis, Meyerhof, Hansen's and Vesic equations for strip, rectangular and circular footing, effect of various BC factor on bearing capacity, use of field test (SPT and Plate Load) data for bearing capacity determination, bearing capacity of rocks, RQD concept

Unit 4 **(7 hrs)**

Settlement of Shallow Foundation:
Consolidation, spring analogy, Terzaghi's theory of one dimensional consolidation, Lab consolidation test, determination of consolidation parameters viz. c_c, c_v , m_v and a_v. Square root and logarithm of time fitting methods. Rate of settlement, normally and over consolidated soils, Determination of pre-consolidation pressure, Evaluation of consolidation settlement, elastic settlement

Unit 5 **(7 hrs)**

Design of Shallow Foundation:
Geotechnical design of isolated and raft foundation, shear failure and settlement criteria.

Unit 6 **(7 hrs)**

Pile and deep Foundation:
Pile classifications, Load carrying capacity of pile, Reaction loading, Bi-directional load test, pile load test, static and dynamic methods, group action, Negative skin friction, Settlement of single and group of piles, introduction to well foundation

Textbooks:

1. Dr. B. J. Kasmalkar, "Foundation Engineering", Pune Vidyarthi Griha Prakashan, Pune.
2. Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, (2010).
3. B. M. Dass, "Foundation Engineering", Cengage Learning; 7 edition

Reference Books:

1. J. E. Bowles, "Foundation Analysis and Design", McGraw-Hill International.
2. N.V. Nayak, "Foundation Design Manual", Dhanpat Rai and Sons, First Edition.

DEC/CE(DE) 21004 GREEN BUILDING PRACTICES

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Understand the economic benefits of a green building. [PEO1][PO1, PSO1]
2. Classify the terms and the construction methodologies between "traditional building" and "green building". [PEO1][PO1, PO5, PSO1]
3. Conduct water audit. [PEO2][PO2, PO5, PSO1]
4. Evaluate the status of building for various green building rating system. [PEO2][PO2, PO5, PSO1]

Unit 1 **(7 hrs)**

Sustainable Site Selection:
Sustainable site selection orientation, building envelop, building plan layout, design of doors and windows, natural ventilation, solar energy, use of solar energy for water heating, solar concentrators, solar photovoltaic panels, direct and indirect lighting, comparison of various lighting devices-electric tubes, incandescent lamps, CFL and LED lamps, indirect lighting devices-light tubes, fibre optic, Fresnel lens.

Unit 2 **(7 hrs)**

Passive and Active Architecture:
Passive and active architecture, Natural ventilation and air conditioning, Hybrid system of active and passive refrigeration and air-conditioning. Concept of Embodied energy of various common building materials. Energy and water audit of building.

Unit 3 **(7 hrs)**

Green Building rating systems:
Various rating systems in Green building, LEED criteria, USGBC, IGBC Green rating, GRIHA criteria, Eco housing, Environmental clearance of buildings

Unit 4 **(6 hrs)**

Water Efficiency:
Water efficiency, Water Efficient Landscaping- Rain water harvesting, potable water and bore well recharging, minimization of water use, dual flush, Waterless urinals, Smart controlled water tabs, Recycling of treated waste water for different non potable use, Domestic solid waste–segregation, green materials

Unit 5 **(6 hrs)**

Indoor Environment Quality:
Indoor environment Quality low-VOC emitting materials. Adhesive and sealants, Paints and coatings, carpet systems, Composite fibre, agro fibre products as like jute, bamboo, coconut and their use as interiors.

Unit 6 **(7 hrs)**

Recycling Techniques:
Recycling of building materials, Exiting walls, roofs and floors, Internal non-structural element, Construction waste management, Materials use, Recycled content, Use of fly ash, foundry sand and other inert solid wastes in building, life cycle analysis, Construction phase, Operation phase, demolition and land use.

Text Books:

1. Michael Bauer, Peter Mösle and Michael Schwarz, "Green Building – Guidebook for Sustainable Architecture" Springer Publication, ISBN 978-3-642-00634-0.
2. IGBC green building rating system, <http://igbc.in/site/igbc/testigbc.jsp?desc=115708&event=115679>
3. Green Rating for Integrated Habitat Assessment(GRIHA). 〈http://www.grihaindia.org〉

Reference Books:

1. Kibert, C. J. "Sustainable construction: Green building design and delivery", Wiley, Hoboken, NJ.
2. LEED for homes green building rating system – U.S. green building council, <http://www.usgbc.org/leed/homes>
3. Building research establishment's environmental assessment method. Design and procurement pre-assessment estimator BREEAM
4. Eco Housing green building rating system. <http://portal.mcgm.gov.in/irj/portalapps/com.mcgm.ecohousing/docs/Eco_housing_Construction.pdf>
5. Comprehensive assessment system for building environmental efficiency. CASBEE for new construction: technical manual 2004 edition. <http://www.ibec.or.jp/CASBEE>
6. ASHRAE Standard 62-1999 Ventilation for Acceptable Indoor Air Quality
7. ASTM E1903-97
8. ASHRAE IESNA Standard: 90.1
9. National Building Code 2005.
10. Jensen, John R. "Remote sensing of the environment: An earth resource perspective"

2/e. Pearson Education India, 2009.
11. Reddy, M. Anji. "Geoinformatics for environmental management." BS publications, 2004.
12. National Building Code 2016

DEC/CE(DE) 21005 MATRIX ANALYSIS OF STRUCTURES

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Analyse Plane Trusses, and Continuous Beams using Matrix Stiffness Method. [PEO1] [PO1, PO2, PSO2]
2. Analyse Plane Frames, and Grids. [PEO1][PO1, PO2, PSO2]
3. Analyse Space Trusses and Space Frames. [PEO1][PO1,PO2, PSO2]
4. Use computer Programs for analysis of Framed Structures. [PEO1] [PO1,PO2,PO5, PSO2] [PEO2] [PO2, PO5, PSO2]

Unit 1 **(6 hrs)**

Introduction:
Analysis of skeletal structures, Basic considerations of structural analysis, Boundary conditions, Flexibility Method, Displacement Method, Stiffness relationships.

Unit 2 **(6 hrs)**

Matrix Displacement Method:
Bar element with axial force, Member stiffness matrix, Bar element subjected to torsion, Stiffness matrix of a beam element, Assembly of the structure stiffness matrix

Unit 3 **(6 hrs)**

Plane Frames:
Pin-jointed frames, Rigid jointed frames, inclined supports, Bandwidth of stiffness matrix, Member Stiffness Relations in the Local Coordinate System, Coordinate Transformations, Stiffness in the Global Coordinate system

Unit 4 **(6 hrs)**

Other Kinds of Loading:
Loading between joints, Effects of temperature change and lack of fit

(6 hrs)

Unit 5

Space Frames:

Grid structures, Ball-jointed space frames, Rigid-jointed space frames, Structure Stiffness Relations

Unit 6 **(6 hrs)**

Programming for Stiffness Method:

Computer Program for Stiffness Analysis of Continuous Beam, Plane Truss, Plane Frame and Space Truss

Text Books:

1. William Weaver and James Gere, "Matrix Analysis of Framed Structures", Springer Publication, 1990.
2. Praveen Nagarajan, "Matrix Analysis of Structural Analysis", CRC Press, 2019
3. Damodar Maity, "Computer Analysis of Framed Structures", I. K. International Publication, 2007.

Reference Books:

1. P. N. Godbole, R. S. Sonparote and S. U. Dhote, "Matrix Methods of Structural Analysis", Prentice Hall Publication, 2012.
2. Aslam Kassimali, "Matrix Analysis of Structures", Cengage Learning, 2010.

DEC/CE(DE) 21006 COMPUTATIONAL METHODS IN CIVIL ENGINEERING

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Mathematically model a physical system. [PEO1][PO1, PO2, PSO2]
2. Identify appropriate numerical method to find solutions of simulated physical system. [PEO1][PO1, PO2, PSO2]
3. Apply the numerical methods to solve Civil Engineering problems. [PEO1][PO1, PO2, PO4, PSO2]
4. Use computer program to get solution of problems in Civil Engineering. [PEO1][PO1, PO2, PO4, PO5, PSO2]

Unit 1 **(8 hrs)**

Introduction:

Basic concepts of Numerical Methods: Mathematical modelling; accuracy and precision; errors analysis

Unit 2 **(6 hrs)**

Roots of Equation:
Graphical Methods; Bisection Method; Secant Method, Newton-Raphson Method; Multiple Roots

Unit 3 **(8 hrs)**

Linear Algebraic Equations:
Numerical Solution of Linear and Nonlinear Simultaneous Equations: Gauss- Elimination, Gauss- Jordan Method, L-U Decomposition Method, Gauss- Seidel Method

Unit 4 **(8 hrs)**

Curve Fitting:
Least Square Regressions, Interpolation by Newton's Formulae, Lagrange Interpolating Polynomials, Spline Interpolation

Unit 5 **(6 hrs)**

Numerical Integration:
Numerical Integration using Newton-Cotes formulae, Gauss-Quadrature, Double Integration

Unit 6 **(6 hrs)**

Ordinary Differential Equation:
Taylor's Series method; Euler's method; Modified Euler's method, Runge-Kutta method (Second and Fourth Order)

Text Books:

1. Chapra, Cannale, "Numerical Methods for Engineers", McGraw-Hill Int. 8th Edition, 2021.
2. Sastry S. S., "Introductory Methods of Numerical Analysis", Prentice Hall of India Delhi, 5th edition, 2012.
3. N Krishna Raju Ku Muthu, Numerical Methods for Engineering Problems, Macmillan Children'S Books, 2nd edition, 2000.

Reference Books:

1. Amos Gilat, "Numerical Methods for Engineers and Scientists", 3rd Edition, Wiley International, 2014.
2. Ascher, U.M. and Greif, C., "A First Course in the Numerical Methods", SIAM Publication, 2011.
3. Khoury, Richard, Harder, Douglas Wilhelm, "Numerical Methods and Modelling for Engineering", Springer International Publishing, 2016.

PCC/CE21011 CONSTRUCTION MANAGEMENT

Teaching Scheme
Lectures: 3hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Learn various basic concepts like safety, laws, site layout related to Construction Management. [PEO1][PO1, PSO2]
2. Understand important aspect of managing the construction project with the help of various networking techniques like Bar Chart/ Milestone Chart, CPM, PERT, Crashing and updating. [PEO2] [PO3, PO4, PO5, PO7, PSO2]
3. Apply various material management theories like ABC, EOQ, HML, VED, SDE, etc. [PEO1][PSO2], [PEO2] [PO2, PO4, PO5]
4. Understand economic analysis and financial management concepts to know economic of feasibility of construction project.
   [PEO1][PO2, PO3, PO5, PO11, PSO1], [PEO2][PO2, PO3, PO5, PO7, PSO1]

Unit 1 **(8 hrs)**

Time Management:
Introduction, role of construction management, steps in Project Management – work break down structure, Bar Chart, Milestone chart, Gantt Chart, Activity on Arrow and Activity On node. Introduction to PERT: Concept of probability, normal and Beta Distribution, Time estimates and calculations of project duration, critical path, slack.

Unit 2 **(6 hrs)**

Network Analysis:
Critical Path Method (CPM): Introduction, Time estimates, floats, critical path, Network Crashing– Least Cost and optimum duration, Updating of networks-needs, steps, project duration, calculation for updated network.

Unit 3 **(8 hrs)**

Resource Management:
Human Resource allocation – smoothening and levelling, Material Management- Objectives, Role, Functions, Qualities of material manager, Inventory Control- Necessity, Techniques such as ABC, EOQ, HML, VED, SDE etc., lead-time, safety stocks, Management Information System.

Unit 4 **(8 hrs)**

Financial Management:
Introduction to Engineering economics, importance, demand and supply, types of costs, Types of interest such as – simple, compound, continuous, effective. Value of Money – time and equivalence, tangible and intangible factors, introduction to inflation. Cost time relationship, Earned Value Analysis.

Unit 5 **(6 hrs)**

Economic Analysis:
Economic comparisons, Discounting methods: Present worth method, equivalent annual cost method, capitalized cost method, net present value, and internal rate of return, Queen theory, decision theory, game theory.

Unit 6 **(6 hrs)**

Miscellaneous:
Site layout, Factors affecting, Typical layout of few major construction projects, Safety Engineering and Management, Introduction of OSHA (Occupational safety and health administration) guidelines, Personal protective equipment, Introduction to Risk Management, Introduction and Types of Contracts and tenders and their procedures.

Text Books:

1. Jha K. N. "Construction Project Management" Pearsons publication.
2. Sengupta B. and Guha H. "Construction Management and Planning", Tata McGraw Hill Publication.
3. Srinath L. S. "PERT &CPM: Principles and Applications", Affiliated East West Press, Delhi
4. B. C. Punmia, "Project Planning and Control with PERT and CPM", Laxmi Publications (P) Ltd.

Reference Books:

1. S. Seetharaman, "Construction Engineering and Management", Umesh Publications
2. K K Chitkara, "Construction Project Management," Tata McGraw-Hill Education
3. K. S. Menon, "Purchasing and Inventory Control", A. H. Wheeler Publishing Company Limited
4. Gopalkrishnan and Sundaresan," Materials Management: An Integrated Approach", PHI Learning Pvt. Ltd.
5. L.C. Jhamb, "Inventory management", Everest Pub. House, Pune, 1987
6. Riggs, J., Bedworth, D. D., and Randhawa S. U., "Engineering Economics" Tata McGraw-Hill Education
7. M. K. Rustogi, "Production and Operation Management", University Science Press

PCC/CE21012 DESIGN OF RC STRUCTURES

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Understand the design philosophy/ fundamental background and principles of reinforced concrete structures. [PEO1][PO1, PSO2], [PEO2][PO2, PSO2]

2. Analyse reinforced concrete structural elements under gravity loads.
   [PEO1][PO1, PO2, PSO2], [PEO2][PO2, PSO2]
3. Design the structural elements as per IS code provisions.
   [PEO1][PO1, PO2, PSO2], [PEO2][PO2, PO3, PO4, PSO2]
4. Gain the skill and learning approach through comprehensive design project.
   [PEO1][PO1, PO2, PSO2], [PEO2][PO2, PO3, PO4, PO5, PSO2]

Unit 1 **(8 hrs)**

Design philosophies of R.C structures (WSM, LSM), Structural elements, loads on structures, and structural properties of concrete, Role of structural engineer. R.C. sections in flexure, theory & analysis, singly, doubly reinforced rectangular and flanged sections.

Unit 2 **(6 hrs)**

One-way and two slabs - simply supported, cantilever and continuous. Design of staircase: Dog legged /open well.

Unit 3 **(8 hrs)**

Design of beams - simply supported, continuous, cantilever -for flexure, shear, bond and torsion, redistribution of moments.

Unit 4 **(8 hrs)**

Design of Column, axially loaded, short & long, uni-axial & biaxial moments.

Unit 5 **(6 hrs)**

Isolated column footing, axial load, uni-axial and biaxial moments. Eccentric footing. Footing in difficult soil conditions.

Unit 6 **(6 hrs)**

Concept of building frame design, Design of cantilever Retaining wall.

Text Books:

1. Punmia, Jain and Jain," Comprehensive Design of R.C. Structures", StandardBook House - New Delhi.
2. Dr. V. L. Shah and Dr. S.R. Karve," Limit State Theory and Design", Pune Vidyarthi Publication.

Reference Books:

1. Limit State Analysis and Design: P. Dayaratnram - Wheeler Publishing Company, Delhi.
2. Sinha," RCC Analysis and Design Vol. II and I", S. Chand and Co. New Delhi.

PCC/CE 21013 HYDROLOGY AND WATER RESOURCES ENGINEERING

Teaching Scheme
Lectures: 3 hrs/week
Tutorial: 1 hr/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Demonstrate the different terminologies related with hydrology and water resources engineering. [PEO1][PO1, PO2]
2. Compute average rainfall, runoff, evaporation loss and other losses from a reservoir/ watershed, crop water requirement, reservoir capacity, canal capacity, and capacity of well. [PEO1][PO1, PO2, PSO2], [PEO2][PO2, PO3, PSO2]
3. Design canal and spillways. [PEO2][PO2, PO3, PO4, PO5, PSO2]
4. Design trial section of gravity dam and earthen dam. [PEO2][PO3, PO4, PSO2]
5. Assess hydropower potential and reservoir capacity. [PEO2][PO2, PO3, PO4, PSO2]

Unit 1 **(7 hrs)**

Surface Water Hydrology: Hydrological Process
Introduction to Hydrology, Hydrological cycle, and application of hydrology. Precipitation, Types of Precipitation, measurement, analysis of Precipitation data, mass rainfall curves, intensity-duration curves, and concept of depth area duration analysis, frequency analysis. Elementary concepts of evaporation, transpiration, evapo-transpiration, and infiltration

Unit 2 **(7 hrs)**

Surface Water Hydrology: Hydrometery
Selection of site, various methods of discharge measurements, Runoff- Factors affecting runoff, rainfall-runoff relationships, runoff hydrograph, unit hydrograph theory, S-curve hydrograph, synthetic unit hydrograph, use of unit hydrograph.
Floods- Estimation of peak flow, rational formula and other methods, flood frequency analysis, Gumbells method, Design floods.

Unit 3 **(6 hrs)**

Ground water hydrology:
Occurrence and distribution of ground water, specific yield of aquifers, movements of ground water, Darcy's law, permeability, safe yield of basin. Hydraulics of well under steady flow condition in confined and unconfined aquifers, specific capacity of a well, well irrigation: tube wells, open wells

Unit 4 **(7 hrs)**

Irrigation Engineering:
Definition, functions, advantages, and necessity. Water requirement of crops, Soil classification, soil moisture and crop water relationship, factors governing consumptive use of water, principal Indian crops, their season and water requirement, agriculture practices. Cropping pattern, Determination of canal capacities, design of canal, Causes of water

logging, preventive and curative measures, Lift irrigation schemes - Various components and their design principles (Only concepts)

Unit 5 **(7 hrs)**

Dams and Reservoirs:
Types of Dam, Choice of dam, various components of dam
Forces acting on gravity dam, design of gravity Dams, low and high gravity dams, construction of gravity dam
Earth dam: Causes of failure of earth dam, stability analysis by Swedish Slip Circle Method.
Reservoir: Types, selection of site, dependability calculations, estimation of required storage and safe yield, mass curve, reservoir sedimentation, reservoir and channel routing.

Unit 6 **(6 hrs)**

Introduction to Hydraulic structures:
Types, Design and drawing of spillways and energy dissipaters, weirs and barrages, Cross drainage works: need, types, design considerations, General features of Hydro-power, general layouts of different types, Assessment of power potential, main components of Hydro-power schemes

Textbooks:

1. K. Subramanya, "Engineering hydrology", Tata McGraw-Hill, New Delhi, (4^{th} Edition)
2. Garg, S.K., "Irrigation Engineering and Hydraulic Structures", Khanna Publications (2009).
3. P. N. Modi, "Irrigation, water resources and waterpower Engineering", Standard book House (2008)
4. Murthy, V.V.N. (1999) "Land and Water Management Engineering", Kalyani Publishers, Ludhiana

Reference Book:

1. VenTeChow, David R. Maidment, Larry W. Mays "Applied Hydrology" Tata McGraw-Hill, New Delhi (2010).
2. Dilip Kumar Majumdar, "Irrigation Water Management (Principles & Practices)", Prentice Hall of India (P), Ltd (2000).
3. Basak, N.N, "Irrigation Engineering", Tata McGraw-Hill Publishing Co (1999)
4. Ralph A. Wurbs, Wesley P. James, "Water Resources Engineering", Prentice Hall of India, (2012)
5. Schwab G. O., Fangmeier, D. D. and Elliot W. J. (1996), "Soil and Water Management Systems", John Wiley and Sons, New York

LC/CE21014 CONSTRUCTION MANAGEMENT LABORATORY

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme: 100 Marks
Term-work: 50 Marks
Oral: 50 Marks

Course Outcomes:

At the end of this course students will be able to:

1. Determine the practical application of construction management.
   [PEO1][PO3, PO5, PO11, PSO1], [PEO2] [PO3, PO5, PO7, PSO1]
2. Determine the time duration, material management, and resource allocation of construction project.
   [PEO1][PO2, PO3, PO5, PSO1] [PEO2][PO2, PO3, PO4, PO5, PO7, PSO1]
3. Perform economic analysis of different projects and equipment. [PEO2][PO3, PSO2]
4. Understand safety of worker, laws related the construction organization.
   [PEO1][PO2, PO3, PO5, PO11, PSO1], [PEO2][PO2, PO3, PO5, PO7, PSO1]

Term work shall be based on the following:

a) Term Work Based on Course Work
   - Resource Management
   - Inventory Control- Necessity, Techniques such as ABC, EOQ etc.
   - Contract documents study (Collect contract documents and interpret it)
   - Site Layout, Plans (Structural, Electrical and Plumbing)
   - OSHA guidelines
   - One assignment in MSP / PRIMAVERA / HITOFFICE Any construction Management software

b) Site Visit to Project Site
   - A report would be presented as a part of course work and shall form the part of term work Course Teacher will arrange all the visits to suit the course work
   - A Laboratory Journal based on the practical work would be prepared for the term-work
   - Oral Examination would be based on the term work. Course Teacher for the Laboratory would decide the breakup of marks for the Oral Examination. An Objective Multiple-Choice Test based on the theory for the Course Work can be conducted as a part of the oral examination

LC/CE21015 DESIGN OF RC STRUCTURES LABORATORY

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme: 100 Marks
Term-work: 50 Marks
Oral: 50 Marks

Course Outcomes:

At the end of this course students will be able to:

1. Adopt general procedure for design of simple RCC structures using relevant IS Codes. [PEO1][PO1, PO3, PO4, PSO2], [PEO2][PO3, PO4, PSO2]
2. Design and draw detailing of RCC elements in the building frame. [PEO2][PO3, PO4, PSO2]

Design Assignments Shall Consist of Following**:**

1. Design of RC building up to 12 m height above GL for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group)
2. Report of a site visit related to RC building structure under construction
3. To the scale sketching would be done in the sketch book by hand and then the drawings would be drafted using Drafting Package/ Auto Cad. Four full size drawing sheets would be drawn using drafting software/ Auto CAD
4. Bar bending schedule & detailing of reinforcements as per standard professional practice and relevant IS codes
5. Emphasis would be given on structural detailing of reinforcement considering the earthquake effects
6. RCC design assignments shall preferably be accepted same/similar to the layout of the building studied in the course Building Design and Drawing.

LC/CE 21016 WATER RESOURCES ENGINEERING LABORATORY

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme: 100 marks
Term-work: 50 Marks
Oral: 50 Marks

Course Outcomes:

At the end of this course students will be able to:

1. Plan catchment area on a topo sheet and compute average rainfall and runoff of a catchment. [PEO1][PO1, PO2, PO5, PSO3]
2. Select the appropriate hydraulic structure/dam. [PEO2][PO2, PO3, PO5, PSO3]
3. Determine the trial section of earth dam/ gravity dam, and check stability. [PEO2][PO2, PO3, PO4, PO5, PSO3]
   Design suitable hydraulic structures /dam, canal. [PEO2][PO3, PO4, PO5, PSO3]

A) Compulsory Assignments

i. Marking Catchments area on a Toposheet and working out average annual rainfall and determining yield.

ii. Stability analysis of Gravity dam.
iii. Stability analysis of an Earth Dam.
iv. Design of a spillway and stilling Basin.
v. Design of canals.

B) Any Two Assignments of The Following

i. Design and analysis of a weir on permeable foundation.
ii. Design of any one type of cross drainage works.
iii. Design of any one type of canal fall and standing wave flume.
iv. To develop a unit hydrograph and to draw a flood hydrograph for given 2 or 3 successive of a water resources projects.
v. Benefit cost analysis of water resources project.
vi. Design of minor irrigation project.
vii. A typical layout of a hydropower plant, function of the components.

C) Report on Site Visit

A report based on visit to any irrigation project during the academic term.

Note:

1) The term work shall consist of record of the above assignments in Journal.
2) Oral examinations will be based on above exercises.

Honor Courses

CE(HO) 21004 ADVANCED MECHANICS OF MATERIALS

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

At the end of the course, the students is able to

1. Analyse simple continuum problems using principles of Solid Mechanics frames by displacement methods. [PEO1][PO1,PO2, PSO2]
2. Idealise continuum problems in structural engineering. [PEO1] [PO1,PO2, PSO2]
3. Determine stability of beams. [PEO1] [PO1,PO2, PSO2]
4. Determine stability of columns and frames. [PEO1] [PO1,PO2, PSO2]
5. Solve simple elasticity and stability problems using computer programs. [PEO1][PO1, PO2, PO4, PO5, PSO2]

Unit 1 **(7 hrs)**

Introduction to Elasticity

Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components

Unit 2 **(6 hrs)**

Equations of Elasticity
Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions

Unit 3 **(10 hrs)**

Two-Dimensional Problems of Elasticity
Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates

Unit 4 **(6 hrs)**

Stability of Beams and Columns:
lateral torsion buckling of beams
Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling

Unit 5 **(6 hrs)**

Stability of Frames:
Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members

Unit 6 **(4 hrs)**

Computer Applications:
Solution of Simple Elasticity Problems using computer programs for Plane Stress and Plane Strain Problems, simple stability problems

Textbooks:

1. Ugural A. C., and Fenster S.K. (2003), "Advanced Strength and Applied Elasticity", Prentice Hall, 2003
2. Srinath L. S. (2008), "Advanced Mechanics of Solids", Tata Mc-Graw Hill, 2008.
3. Hearn E. J., (1997) "Mechanics of Materials-2", Butterworth Heinemann, 1997
4. Timoshenko and Gere, (1981) " Theory of elastic stability", Tata Mc Graw Hill
5. Iyengar, N. G. R. "Structural Stability of columns and plates", Eastern west press Pvt. Ltd.

Reference Book:

1. Boresi A. P., and Schmidt R. J., "Advanced Mechanics of Materials", Wiley, 2003.
2. Alexander Chajes, " Principles of Structural Stability Theory", Prentice Hall, New Jersey

CE(HO) 21005 ADVANCED GEOTECHNICAL ENGINEERING

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

At the end of the course, the students are able to

1. Identify the type of soil and accordingly choose the required shear strength parameters. [PEO1] [PO1, PO3, PSO2]
2. Compute consolidation settlement.
   [PEO1][PO1, PO2, PO3, PO5, PSO2], [PEO2] [PO2, PO4, PO5, PSO2]
3. Carry out geotechnical design of retaining structures.
   [PEO2] [PO3, PO4, PO5, PSO2]
4. Assess the stability of soil slopes.
   [PEO1] [PO1, PO2, PO5, PSO2] [PEO2] [PO2, PO4, PO5, PSO2]
5. Select effective soil stabilisation and ground improvement technique.
   [PEO1] [PO1, PO2, PO5, PSO2] [PEO2] [PO2, PO4, PO5, PSO2]

Unit 1 **(6 hrs)**

Clay mineralogy and clay structures:
Composition of clay minerals, Atoms and Atomic Bonds, Types of Clay Minerals and their Structure, Clay Water Relations, Clay Particle Interaction, Soil Structure and Fabric, Black Cotton Soil: Swelling Pressure.

Unit 2 **(8 hrs)**

Compressibility of Soil and Consolidation:
Components of total settlement, Compressibility: Effects of Soil Types; Role of stress History; Role of Effective Stress, Time Rate of Consolidation: Mechanics; Terzaghi's Theory of One Dimensional Consolidation, Consolidation Test, Determination of Coefficient of Consolidation, Computation of Settlement, Extrapolation of Field Consolidation Curve, Settlement Analysis, Vertical Sand Drains, PVD

Unit 3 **(7 hrs)**

Shear Strength behaviour of soil:
Shear strength of clayey and sandy soils under different drainage conditions, Selection of appropriate shear strength parameters for different field conditions, Skempton's pore pressure parameters, Stress path method and its use, Stress-Strain behaviour of soil, Elastic Properties of Soils

Unit 4 **(7 hrs)**

Soil Retaining Structures:
Design Considerations for Retaining Walls, Design of retaining walls, and Introduction to reinforced earth wall

Unit 5 **(7 hrs)**

Stability of Slopes:
Total Stress and Effective Stress Methods of Analysis, Methods of Slices, Location of the most critical slip circle, Stability of Earth Dam Slopes, Stability analysis –Modified Bishops method, Taylors Stability Number and stability curves, Effect of Earthquake Force: Pseudo Static Analysis

Unit 6 **(6 hrs)**

Soil Stabilisation and Ground Improvement:
Need of the Soil Stabilisation, Cement-Lime Stabilisation, Use of geosynthetics in ground improvement.

Textbooks:

1. Basic and Applied Soil Mechanics by Gopal Ranjan and Rao, New Age International Publishers
2. Principles of geotechnical engineering by B. M. Das, Cengage Learning (Thompson)
3. Soil Mechanics and foundation Engineering, Dr. K. R. Arora, Standard Publishers Distributors.

Reference Book:

1. Soil Mechanics and Foundations, Muni Budhu, John Wiley and Sons Inc
2. Foundation Analysis and Design, J. E. Bowles, McGraw Hill International
3. Advanced Soil Mechanics, B. M. Das, Tata McGraw Hill.

Minor Course

CE(MI)21002 FUNDAMENTALS OF GEOMECHANICS

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme: 100 marks
T1 and T2 - 20 Marks each
End Sem. Exam. - 60 Marks

Course Outcomes:

At the end of the course, the students are able to

1. Select suitable types of soil. [PEO1] [PO1, PO2, PSO2], [PEO2][PO2, PO7, PSO2]
2. Calculate index properties of soil.
   [PEO1] [PO1, PO2, PSO2], [PEO2][PO2, PO7, PSO2]
3. Classify the soil. [PEO1] [PO1, PO2, PSO2], [PEO2][PO2, PO7, PSO2]
4. Compute the permeability of soil.
   [PEO1] [PO1, PO2, PSO2], [PEO2][PO2, PO7, PSO2]
5. Suggest suitable method for compaction of soil.
   [PEO1] [PO1, PO2, PSO2], [PEO2][PO2, PO7, PSO2]
6. Identify different geotechnical structures and their failure modes.
   [PEO1] [PO1, PO2, PSO2], [PEO2][PO2, PO7, PSO2]

Unit 1 **(7 hrs)**

Common Types of Soils in India:
Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils, lateritic soils, alluvial deposits and desert soils.

Unit 2 **(7 hrs)**

Index Properties of Soil:
Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance. Grain-size distribution, Consistency of Clays- Atterberg Limits- Liquid Limit, Plastic Limit, Shrinkage Limit.

Unit 3 **(7 hrs)**

Soil Classification:
Unified Soil Classification System, Indian Standard Soil Classification System, Application of Soil Classification.

Unit 4 **(7 hrs)**

Permeability of Soil:
Darcy's law. Factors affecting permeability. Determination of permeability by constant head and falling head method, field permeability tests.

Unit 5 **(7 hrs)**

Compaction:
Soil compaction phenomenon. Factors affecting compaction. Dry density and moisture content relationship. Zero air voids line. Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test. Field compaction.

Unit 6 **(7 hrs)**

Geotechnical Structures:
Foundations- Shallow foundations, pile foundations, well foundations. Retaining Structures- Sheet pile walls, Reinforced earth walls, braced cuts, Infinite Slopes and Finite slopes. Common Failure modes, Factor of Safety.

Textbooks:

1. Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", G. K. Publications Pvt. ltd
2. V. N. S. Murthy, "Soil Mechanics and Foundation Engineering", B. S. Publications (3rd Edition)
3. Dr. B. J. Kasmalkar ,"Geotechnical Engineering", Pune Vidyarthi Griha Prakashan, 1986

Reference Book:

1. Joseph E Bowles, "Engineering Properties of Soils And Their Measurements", McGraw Hill Publications (2001)
2. Lambe and Whitman, "Soil Mechanics", S. Chand publications (SI Version), (1969).
3. Donald P Coduto, Man-chu Ronald Yeung and William A. Kitch "Geotechnical Engineering Principle and practice", McMillan Press (PHI) (2010)
4. Compendium of Indian standards on soil engineering part 1 (1980)