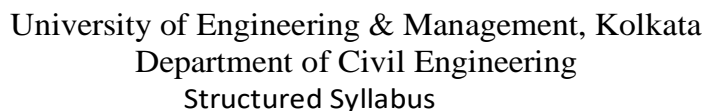


A.THEORY

Sl. No.	Type	Subject Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
1	GE	HSMC301	Values and Ethics in Profession	3	0	0	3	2
2	CC	CE301	Solid Mechanics	3	1	0	4	3
3	CC	CE302	Surveying	3	1	0	4	3
4	CC	CE303	Building Material & Construction	2	1	0	3	2
6	BSC	CH301	Basic Environmental Engineering & Disaster Management	2	1	0	3	2
7	HSMC	HSMC302	Essential Studies for Professionals - III	3	0	0	3	2
8	MOOC	MOOC301	NPTEL ONLINE COURSE	0	0	0	0	3
Total of Theory							20	17
B. PRACTICAL								
9	CC	CE391	Solid Mechanics Lab	0	0	2	2	1
10	CC	CE392	Surveying Practice Lab - I	0	0	2	2	1
11	CC	CE393	Building Design and Drawing Lab	0	0	2	2	1
13	HSMC	HSMC382	Skill Development for Professionals – III	0	0	2	2	1
14	Mandatory Course (Non Credit)	MC301	Mandatory Additional Requirement(MAR) (Co-Curricular/Extra Curricular Activity)	0	0	0	0	0
Total of Practical							8	4
Total of Semester							28	21



A.THEORY

Sl No.	Type	Subject Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
1	BSC	BSC(CS)402	Numerical Methods	2	1	0	3	2
2	BSC	M402	Mathematics-III	3	1	0	4	3
3	GE	CE401	Fluid Mechanics	2	1	0	3	2
4	CC	CE402	Structural Analysis	3	1	0	4	3
5	CC	CE403	Soil Mechanics	2	1	0	3	2
6	HSMC	HSMC402	Essential Studies for Professionals - IV	3	0	0	3	2
7	MOOC	MOOC401	NPTEL ONLINE COURSE	0	0	0	0	3
Total of Theory							20	17
B. PRACTICAL								
8	BSC	BSC(CS)492	Numerical Methods Lab	0	0	2	2	1
9	CC	CE491	Fluid Mechanics Lab	0	0	2	2	1
10	CC	CE492	Soil Mechanics Lab I	0	0	2	2	1
11	HSMC	HSMC482	Skill Development for Professionals – IV	0	0	2	2	1
12	Mandatory Course (Non Credit)	MC401	Mandatory Additional Requirement(MAR) (Co-Curricular/Extra Curricular Activity)	0	0	0	0	0
	Total of Practical						8	4
	Total of Semester						28	21



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Third Year – Fifth Semester							
A.THEORY							
Sl. No.	Subject Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	HU501	Economics for Engineers	3	0	0	3	3
2	CE501	Foundation Engineering	3	1	0	4	4
3	CE502	Design of RCC Structures	3	1	0	4	4
4	CE503	Concrete Technology	3	0	0	3	3
5	CE504	Engineering Geology	3	0	0	3	3
6	CE505C	Free Elective I: Microprocessors & Microcontrollers	3	0	0	3	3
7	GS501	Essential Studies for Professionals - V	3	1	0	4	2
8	MOOC501	NPTEL ONLINE COURSE	0	0	0	0	3
Total of Theory						24	22+3
B. PRACTICAL							
9	CE591	Soil Mechanics Lab-II	0	0	3	3	2
10	CE592	Concrete Laboratory	0	0	3	3	2
11	CE593	Quantity Surveying, Specifications and Valuation	0	0	3	3	2
12	CE 594	Engineering Geology Laboratory	0	0	3	3	2
13	CE595C	Free Elective I Lab: Microprocessors & Microcontrollers Lab	0	0	3	3	2
14	GS581	Skill Development for Professionals – V	2	1	0	3	1
Total of Practical						18	11

Free Elective-I			Free Elective-I Lab		
Sl. No.	Paper Code	Paper Name	Sl. No.	Paper Code	Paper Name
1	CE505A	Database Management System	1	CE595A	Database Management System Lab
2	CE505B	Operating System	2	CE595B	Operating System Lab
3	CE505C	Microprocessors & Microcontrollers	3	CE595C	Microprocessors & Microcontrollers Lab



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Third Year – Sixth Semester							
A.THEORY							
Sl. No.	Subject Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	HU601	Principles of Management	2	0	0	2	2
2	CE601	Highway & Transportation Engineering	3	0	0	3	3
3	CE602	Design of Steel Structure	3	0	0	3	3
4	CE603	Construction Planning & Management	3	0	0	3	3
5	CE604B	Professional Elective – I: Pre stressed Concrete	3	0	0	3	3
6	CS605	Free Elective II: Data Science & Data Analytics	3	0	0	3	3
7	GS601	Essential Studies for Professionals - VI	3	1	0	4	2
8	MOOC601	NPTEL ONLINE COURSE	0	0	0	0	3
Total of Theory						21	19+3
B. PRACTICAL							
9	CE691	Highway & Transportation Engineering Lab	0	0	3	3	2
10	CE692	Detailing of RC and Steel Structures	0	0	3	3	2
11	CE693	Computer Aided Design Lab	0	0	3	3	2
12	CE 681	Seminar	0	0	3	3	2
13	CS 695A	Free Elective II Lab: Data Science & Data Analytics Lab	0	0	3	3	2
14	GS681	Skill Development for Professionals – VI	2	1	0	3	1
Total of Practical						18	11

Professional Elective-I			Free Elective-II		
Sl. No.	Paper Code	Paper Name	Sl. No.	Paper Code	Paper Name
1	CE604A	Bridge Engineering	1	CS605A	Data Science & Data Analytics
2	CE604B	Pre Stressed Concrete	2	CE605B	Software Engineering
3	CE604C	Structural Dynamics and Earthquake Engineering	3	CE605C	Operation Research



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Fourth Year – Seventh Semester							
A.THEORY							
Sl. No.	Subject Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	CE701	Environmental Engineering	3	0	0	3	3
2	CE702	Hydrology & Water Resource Engineering	3	0	0	3	3
3	CE703A	Professional Elective II: Advanced Highway & Transportation Engineering	3	0	0	3	3
4	CE704A	Professional Elective III: Advanced Structural Analysis	3	0	0	3	3
5	CE705C	Free Elective – III: Irrigation Engineering & Hydraulic Structures	3	0	0	3	3
6	GS701	Essential Studies for Professionals – VII	3	1	0	4	2
7	MOOC701	NPTEL ONLINE COURSE	0	0	0	0	3
Total of Theory						19	17+3
B. PRACTICAL							
8	HU781	Group Discussion	0	0	3	3	2
9	CE791	Environmental Engineering Lab	0	0	3	3	2
10	CE792	Civil Engineering Practice Sessional	0	0	3	3	2
11	CE 793C	Free Elective – III Lab: Management Principles for Engineers Practice	0	0	3	3	2
12	CE782	Industrial Training					2
13	CE783	Project I				6	2
14	GS781	Skill Development for Professionals – VII	2	1	0	3	1
Total of Practical						21	13

Professional Elective II			Professional Elective III		
Sl. No.	Paper Code	Paper Name	Sl. No.	Paper Code	Paper Name
1	CE703A	Advanced Foundation Engineering	1	CE704A	Advanced Structural Analysis
2	CE703B	Soil Stabilization & Ground Improvement Technique	2	CE704B	Hydraulic Structures
3	CE703C	Advanced Highway & Transportation Engineering			
Free Elective III			Free Elective III Lab		
Sl. No.	Paper Code	Paper Name	Sl. No.	Paper Code	Paper Name
1	CE705A	Engineering Materials	1	CE793A	Material Testing lab
2	CE705B	Electrical & Electronic Measurement	2	CE793B	Electrical & Electronics Measurement lab
3	CE705C	Irrigation Engineering & Hydraulic Structures	3	CE793C	Management Principles for Engineers Practice



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Fourth Year – Eighth Semester							
A.THEORY							
Sl. No.	Subject Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	HU801A/ HU801B	Organizational Behavior Project Management	2	0	0	2	2
2	CE801A	Professional Elective IV: Environmental Pollution and Control	3	0	0	3	3
3	CE802D	Professional Elective V: Pavement Design	3	0	0	3	3
4	GS801	Essential Studies for Professionals – VIII	3	1	0	4	2
5	MOOC801	NPTEL ONLINE COURSE	0	0	0	0	3
Total of Theory						12	10+3
B. PRACTICAL							
6	CE891	Structural Engineering Design Practice	0	0	6	6	4
7	CE881	Project II	0	0	12	12	6
8	CE882	Grand Viva					3
9	GS881	Skill Development for Professionals – VIII	2	1	0	3	1
Total of Practical						21	14

Professional Elective-IV			Professional Elective-V		
Sl. No.	Paper Code	Paper Name	Sl. No.	Paper Code	Paper Name
1	CE801A	Environmental Pollution and Control	1	CE802A	Finite Element Method
2	CE801B	Water Resources Management & Planning	2	CE802B	Dynamics of Soils & Foundations
3	CE801C	Remote Sensing and GIS	3	CE802C	Design of Tall Buildings
4	CE801D	Disaster Management in Civil Engineering	4	CE802D	Pavement Design

Second Year Third Semester

THEORY

Theory: VALUES & ETHICS IN PROFESSION

Paper Code: HU-301

Contacts: 3L

Credits- 2

Science, Technology and Engineering as knowledge and as Social and Professional Activities

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development.

Energy Crisis: Renewable Energy Resources

Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics

Appropriate Technology Movement of Schumacher; later developments

Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.

Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.

Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society

Nature of values: Value Spectrum of a good life

Psychological values: Integrated personality; mental health

Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.

Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity

Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Textbook:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A. N. Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Theory: SOLID MECHANICS

Code: CE-301

Contacts: 3L+1T

Credits: 3

Details of Course Content:

1. Review of Basic Concepts of Stress and Strain: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety.
2. Beam Statics: Support reactions, concepts of redundancy, axial force, shear force and bending moment diagrams for concentrated, uniformly distributed, linearly varying load, concentrated moments in simply supported beams, cantilever and overhanging beams.
3. Symmetric Beam Bending: Basic kinematic assumption, moment of inertia, elastic flexure formulae and its application, Bending and shear stress for regular sections, shear centre
4. Deflection of statically determinate beams: Fundamental concepts: Elastic curve, moment Curvature relationship, governing differential equation, boundary conditions: Direct integration Solution.
5. Analysis of determinate plane trusses: Concepts of redundancy, Analysis by method of joints, method of sections
6. Two Dimensional Stress Problems: Principal stresses, maximum shear stresses, Mohr's circle of stresses, construction of Mohr's circle
7. Introduction to thin cylindrical & spherical shells: Hoop stress and meridional - stress and volumetric changes.
8. Torsion: Pure torsion, torsion of circular solid shaft and hollow shafts, torsional equation, torsional rigidity, closed coil helical; springs.
9. Columns: Fundamentals, criteria for stability in equilibrium, column buckling theory, Euler's load for columns with different end conditions, limitations of Euler's theory – problems, eccentric load and secant formulae.

Reference Books:

1. Elements of Strength of Material S. P. Timoshenko & D. H. Young EWP Pvt. Ltd
2. Engineering Mechanics of Solids E. P. Popov Pearson Education
3. Strength of Materials R. Subramanian OXFORD University Press
4. Strength of Material Bansal
5. Strength of Materials S S Bhavikatti Vikas Publishing House Pvt. Ltd
6. Strength of Material A. Pytel & F. L. Singer AWL Inc
7. Strength of Material Ramamrutham
8. Engineering Mechanics I by J. L. Mariam John Willey
9. Engineering Mechanics I. H. Shames PHI
10. Fundamentals of Strength of Material Nag & Chandra WIE

Theory: SURVEYING

Code: CE-302

Contacts: 3L+1T

Credits: 3

Details of Course Content:

1. Introduction: Definition, classification of surveying, objectives, principles of surveying.
2. Chain surveying: Chain and its types, Chaining for obtaining the outline of structures, Methods for overcoming obstacles, Conventional symbols, Plotting chain survey and Computation of areas, Errors in chain surveying and their elimination: Problems.
3. Compass Surveying: Details of prismatic compass, Use and adjustments, Bearings, Local attraction and its adjustments. Chain and compass surveying of an area, Booking and plotting, Adjustments of traverse, Errors in compass surveying and precautions: Problems.
4. Levelling: Introduction, Basic definitions, Detail of dumpy Level, Temporary adjustment of Levels, Sensitiveness of bubble tube; Methods of levelling – Differential, Profile & fly Levelling, Effect of curvature and refraction, Automatic levels, Plotting longitudinal sections and Cross sections; Measurement of area and volume.
5. Contouring: Characteristics, methods, uses; areas and volumes, Methods of Locating Contours, Interpolation of Contours.
6. Theodolite Surveying: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation -network- Signals. Baseline - choices - instruments and accessories - extension of base lines -corrections - Satellite station
- reduction to centre – Inter-visibility of height and distances -Trigonometric leveling.
7. Simple & Transition Curves: Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves.
8. Introduction to Total Station with Field applications, Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey
9. Photogrammetry Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry.
10. Remote Sensing: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition.

Reference Books:

1. Surveying:- Vol - I & II B.C. Punmia
2. Surveying & Levelling R. Subramanian (OXFORD)
3. Surveying& Levelling Vol - I [Part I & II] T.P. Kanetkar & Kulkarni
4. Surveying:- Vol - I & II S.K. Duggal
5. Fundamental of Engineering Survey J.K. Ghosh (Studium Press, Roorkee)
6. Higher Surveying Dr. A. M. Chandra
7. Surveying R.B. Gupta & B.K. Gupta
8. Plane and Geodetic Surveying (Vol - I & II) David Clark
9. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GI Sand Remote Sensing, Pearson India, 2006.
10. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011

11. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
12. Anji Reddy, M., Remote sensing and Geographical information system, B.S.Publications, 2001.
13. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

Theory: BUILDING MATERIAL AND CONSTRUCTION

Code: CE-303

Contacts: 2L+1T

Credits: 2

Details of Course Content:

BUILDING MATERIALS

1. Bricks: Classification, Characteristics of good bricks, Ingredients of good brick earth, Harmful substance in brick Earth, Different forms of bricks, Testing of bricks as per BIS. Defects of bricks.
2. Aggregates: Classification, Characteristics, Deleterious substances, Soundness, Alkali – aggregates reaction, Fine aggregates, Coarse aggregates, Testing of aggregates.
3. Lime: Impurities in limestone, Classification, Slaking and hydration, Hardening, Testing, Storage, Handling.
4. Cement & Concrete:
Cement: OPC: Composition, PPC, Slag cement, Hydration, setting time.
Concrete: Types, ingredients, W/C ratio, Workability, Different grades in cement concrete, Testson cement concrete.
5. Mortars: Classification, Uses, Characteristics of good mortar, Ingredients. Cement mortar, Lime mortar, Lime cement mortar, special mortars
6. Wood and Wood Products: Classification of Timber, Structure, Characteristics of good timber, Seasoning of timber, Defects in Timber, Diseases of timber, Decay of Timber, Preservation of Timber Testing of Timber, Veneers , Plywood, Fibre Boards, Particle Boards, Chip Boards , Black Boards, Button Board and Laminated Boards, Applications of wood and wood products.
7. Paints, Enamels and Varnishes: Composition of oil paint, characteristic of an ideal paint, preparation of paint, covering power of paints, Painting: Plastered surfaces, painting wood surfaces, painting metal Surfaces. Defects, Effect of weather, enamels, distemper, water wash and colourwash, Varnish , French Polish, Wax Polish.
8. Miscellaneous Materials: Gypsum: Classification, Plaster of Paris, Gypsum wall Plasters, Gypsum Plaster Boards, Adhesives, Heat and sound insulating materials, Geo-synthetic.

BUILDING CONSTRUCTION

9. Foundations: Function of Foundations, Essential requirement of good foundation, Different types of shallow and deep Foundations.
10. Brick masonry: Definitions, Rules for bonding, Type of bonds – stretcher bond, Header bond, English bond, Flemish Bond, Comparison of English Bond and Flemish Bond (one and one and half brick thick wall) Wall, Doors and Windows: Load bearing wall, Partition wall, Reinforced brick wall Common types of doors and windows of timber and metal.
11. Stairs: Technical Terms, Requirements of good stair, Dimension of steps, Classification, Geometric design of a dog legged stair case

12. Flooring: Components of a floor, selection of flooring materials, Brick flooring, Cement concrete flooring, mosaic, marble, Terrazzo flooring, Tiled roofing.
13. Plastering and Pointing: Plastering with cement mortar, Defects in plastering, pointing, whitewashing, colour washing, Distempering.
14. Roofs: Types, Pitched roofs and their sketches, Lean – to roof, King Post – Truss, Queen post truss and Simple steel Truss, Roof Covering materials: AC sheets GI sheet.

Reference Books:

1. Building Materials S.K. Duggal
2. Building Materials P.C. Varghese PHI
3. Engineering Materials S.C. Rangwala
4. Concrete Technology M. S. Shetty
5. Concrete Technology[A.M. Neville& J.J. Brooks Pearson Education
6. Building Construction B.C. Punmia
7. Building Construction and Foundation Engineering Jha and Sinha.

Theory: BASIC ENVIRONMENTAL ENGINEERING & DISASTER MANAGEMENT

Paper Code: CH301

Contacts: 2L+1T

Contacts: 2

Module I General

Basic ideas of environment, basic concepts, man, society & environment, their interrelationship. Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development.

Module II Ecology

Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem; Food chain [definition and one example of each food chain], Food web. Biogeochemical Cycle Oxygen, carbon, Nitrogen, Phosphate, Sulphur. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of Biodiversity

Module III Air pollution and control

Atmospheric Composition, Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food,. Global warming and its consequence, Control of Global warming. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes.

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.

Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. Smog, Photochemical smog and London smog. Acid Rain

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification.

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, scrubber).

Module IV Water Pollution and Control

Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds.

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. Standard and control: Waste water standard [BOD, COD, Oil, Grease], Lake: Eutrophication [Definition, source and effect].

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.

Module V Land Pollution

Lithosphere; Internal structure of earth, rock and soil

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.

Solid waste management and control (hazardous and biomedical waste).

Module VI Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index), Leq, Leqn . Noise pollution control.

Module VII Environmental Management

Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.

Module VIII Disaster Management

Understanding disaster-concepts and definition of disaster, hazards, vulnerability, risk and disaster management

Anthropogenic disaster: Cause, damage/loss and combative mechanisms of A. Bomb threat, B. Explosive, C. Hazardous material spill, D. Financial emergency such as i. Sudden health emergency, ii. unexpected loss of income, iii. Death in family and other families iii. Rent in areas and risk of eviction

Natural disaster: Flood, earthquake, Landslide-causes and effects

Disaster management- Risk assessment, risk analysis and mapping, awareness, preparedness, early warning system, evacuation, search and rescue, relief and rehabilitation, restoration and recovery.

Theory: ESSENTIAL STUDIES FOR PROFESSIONAL-III

Paper Code: GS-301

Contacts: 3L

Credits: 2

Module-1 History-3 (National movement):

Indian Society in transition: Cultural Encounter and Socio-cultural changes: • Introduction of western education and modern ideas • Reform movements - Ram Mohan Roy, Brahmo Samaj, Young Bengal, Vidyasagar, Arya Samaj, Vivekananda and Ramkrishna Mission. • Women's Question and Indian Reformers • The Growth of modern vernacular literature, press and public opinion, growth and spread of scientific ideas. • The Faraizi and Wahabi movements; The Aligarh movement, Deoband School. • Social Reform movements in the late 19th and early 20th centuries (including depressed caste movements) – a broad overview.

Resistance to the British rule: • Early uprisings against the British rule in 18th and 19th centuries (1757 - 1856) with special reference to Bengal and eastern India. • The Revolt of 1857 - genesis, course, character, causes of its failure and its impact. • The Act of 1858 and the establishment of the British Raj.

Growth of Nationalism (1858 - 1918): Factors leading to birth of Indian Nationalism - Early Political Associations - The foundation of the Indian National Congress (1885) - The Safety-valve thesis - Programme and objectives of the early Congress - Economic Nationalism and Drain Theory - The moderates and the extremists - the Partition of Bengal (1905) - The Swadeshi Movement in Bengal and other provinces - the economic, cultural and political aspects of Swadeshi movement.

Gandhian Era (1919 - 1947): Rise of Gandhi - Character of Gandhian nationalism - the Rowlatt Satyagraha - The Khilafat - the Non Co-operation movement - Simon Commission, Nehru Report and Round Table Conferences - Civil Disobedience Movement - Quit India Movement. The Left: The Left within the Congress and Jawaharlal Nehru - Subhas Chandra Bose and the INA - the Congress Socialist Party - the Communist Party of India - other left parties. The Peasant Movement. The Working Class and Trade Union Movements. Women's organisations, development of women issues and the role of women in nationalist movement. The Peoples' Movement in Princely States. The Post - War upsurge Growth of Muslim Separatism - Rise of Muslim League - Demand for Pakistan Hindu Nationalism Depressed Classes and caste politics with special reference to the role of B. R. Ambedkar. Communalism, British Policy, Partition and Independence.

Module-2 WORLD GEOGRAPHY

- i) Major Natural Regions: Characteristics, economic base and human adaptation.
- ii) Regional Geography of Developed Countries: Canada, U.S.A., Western Europe, Russia, Japan, Australia and New Zealand.
- iii) Regional Geography of Developing Countries: S.E. Asia, S.W. Asia, China, Southern Africa and Brazil.
- iv) Regional Geography of South Asia

Module-3**MACRO ECONOMICS**

- 1) National income- Concept of GDP, GNP, NNP both in FC & MP, PCI
- 2) Tax – Concept of TAX , objective of TAX, Direct & Indirect Tax, Progressive, Regressive & Proportional tax.
- 3) RBI & Banking- Traditional Functions of RBI, CRR, SLR, REPO, Reverse repo, MSF, LAF, money market, capital market, FOREX.
- 4) Budget- concept of budget, components of budget, different types of deficit
- 5) Keynesian outlook- IS,LM & different multipliers.
- 6) Inflation & Deflation- Inflation & its impact, Deflation & its impact, WPI, CPI, GDP deflator.

Module-4 CONSTITUTION-3(Advance)

- 1) Central State relation, Interstate relation,
- 2) Supreme Court-Appointment of Chief Justice, Acting Chief Justice, Qualification, Oath or Affirmation, Tenure of Judge, Removal of Judges, Salaries & allowance, Adhoc Judge, Procedure of the court, write jurisdiction, Power of Judicial review
- 3) High Court-Appointment of Chief Justice, Acting Chief Justice, Qualification, Oath or Affirmation, Tenure of Judge, Removal of Judges, Salaries & allowance, Adhoc Judge, Procedure of the court, write jurisdiction, Power of Judicial review
- 4) Duties & Powers of Attorney & Advocate General in Brief Panchayati Raj- Three tier system, Different committees recommendation
- 5) Municipality, Municipal Council & Corporation, Official Languages & related Articles.
- 6) Formation of UPSC, Related Articles, Scope & Power, Duties of CAG, Formation SPSC, Related Articles, Scope & Power.
- 7) Election Commission- Related Articles, Power & Function & Provision of Election
- 8) Emergency Provisions- Related Articles, Conditions Application, Supreme power during emergency.
- 9) National Commission for SC/ST/OBC, Function of the commissions, Special offer & related articles for SC/ST/OBC

10) Different amendments of Indian Constitution & the related article

Ref Books:

History:

India's Ancient Past (Ancient History) : R.S. Sharma

History of medieval India (Medieval History): Satish Chandra

History of Modern India (Modern History): Bipin Chandra

India's struggle for Independence (Modern History): Bipin Chandra

Geography:

India-Khullar

Economics:

Indian Economy-TATA Mc Graw Hill/Ramesh Singh

Indian Economy – Arihant

Constitution:

Indian Constitution-D.D. Basu

Our Constitution-Subhash.C. Kashyap

PRACTICAL

Practical: SOLID MECHANICS LAB

Paper Code: CE-391

Contacts: 2P

Credits – 1

1. Tension test on Structural Materials: Mild Steel and Tor steel (HYSD bars)
2. Compression Test on Structural Materials: Timber, bricks and concrete cubes
3. Bending Test on Mild Steel
4. Torsion Test on Mild Steel Circular Bar
5. Hardness Tests on Ferrous and Non-Ferrous Metals: Brinnel and Rockwell Tests
6. Test on closely coiled helical spring
7. Impact Test: Izod and Charpy
8. Demonstration of Fatigue Test

Practical: SURVEYING PRACTICE LAB-I

Paper Code: CE-392

Contacts: 2P

Credits -1

1. Chain surveying- DETERMINATION OF POLYGON AREA BY CHAIN SURVEY (Getting outline of the structures by enclosing them in triangles/quadrilaterals, Distance between inaccessible points)
2. Compass surveying- CLOSED TRAVERSING USING COMPASS (Measurement of bearings, Preparation of map)
3. Traversing by Using Theodolite:
 - A. DETERMINATION OF ELEVATION OF VARIOUS POINTS
 - B. THEODOLITE TRAVERSING-DEFLECTION ANGLE METHOD
 - C. THEODOLITE TRAVERSIING-INCLUDED ANGLE METHOD

Preparation of Gales Table from field data

4. Traversing by using Total Station

A. DETERMINATION OF AREA USING TOTAL STATION

B. TRAVERSING USING TOTAL STATION Use of

Total Station for levelling

5. Contouring (PREPARATION OF CONTOUR DRAWINGS, LONG SECTIONS, BALANCING OF EARTH)

6. Setting out of Simple Curves- SIMPLE CURVE SETTING - OFFSETS FROM LONG CHORD.

Practical: BUILDING DESIGN AND DRAWING

Code: CE 393

Contacts: 2P

Credits: 1

1. Foundations

Spread foundation for walls and columns; Footing for a RCC column, raft and pile foundations;

2. Doors and Windows

Glazed and paneled doors of standard sizes; Glazed and paneled windows of standard sizes; special windows and ventilators

3. Stairs

Proportioning and design of a dog-legged, open well RCC stair case for an office / Residential building; Details of reinforcements for RCC stair cases; Plan and elevation of straight run, quarter turn, dog-legged and open well stair cases.

4. Roofs and Trusses

Types of sloping roof, lean-to roofs, RCC roof with details of reinforcements, King post and Queen post trusses.

5. Functional Design of Buildings

To draw the line diagram, plan, elevation and section of the following:

Residential Buildings (flat, pitched and combined roofs), Office Buildings (flat roof), School

The designs must show positions of various components including lift well and their sizes.

6. Introduction to drawing by using software package

Text Books

1 Principles of Building Drawing by Shah & Kale

2 Text Book of Building Construction by Sharma & Kaul

3 Building Construction by B C Punmia

Practical: SKILL DEVELOPMENT FOR PROFESSIONALS-III

Paper Code: GS-381

Contacts: 2P

Credits: 1

Module-1 Quantitative Numerical aptitude-3

- 1) Simple & Compound Interest- Basic concept of SI & CI, different formulas & their applications, concept of Growth & Contraction of Business.
- 2) Data Interpretation- Tables, pie chart, histogram, Bar chart, solution tricks & techniques.
- 3) Quant Review- Miscellaneous problems from different chapters & short cuts.
- 4) Indices & Surds- Basic concept, Formulae & their applications, Finding out the square roots, Elimination of Surds, Equation solve.
- 5) Quadratic Equation- polynomials, degree, powers, Equation & factors Solution. Progression- Concept of AP, GP & HP

Module-2 Objective English-3

1. Reading Comprehension (Advance Level)
2. Rearrangements of Sentences, Jumbles Sentences, Sentence Improvement
3. Fill the blanks with appropriate words/ articles/preposition/verbs/adverbs/conjunction.
4. Cloze Test (Fill the blanks with appropriate words in the given paragraph)

Module-3 Logical Mental Ability-3

LOGICAL REASONING a) Statement And Assumption, b) Statement And Conclusion, c) Statement And Course Of Action, d) Cause And Effect, e) Drawing Inference
Machine Input-Output a) Pattern Based I/O
Inequality a) Coded Inequality, b) Jumbled Inequality, c) Conditional inequality
Calendar And Clock a) Miscellaneous Problems

Ref Books:**Quant**

Fastrack objective Arithmetic: Arihant

Quantitative aptitude for Competitive exam (4th Edition): TATA Mc Graw Hill

Quantitative aptitude for Competitive exam (3rd Edition): PEARSON

Verbal Ability

Objective English: Kiran Publication

General English: Arihant

LOGICAL REASONING

Analytical & Logical Reasoning: M.K. Pandey/B.S.C. Publication

A modern approach to verbal & non verbal Reasoning: R.S. Agarwal.

Second Year Fourth Semester
THEORY

Theory: NUMERICAL METHODS

Paper Code: BSC (CS) 402

Contacts: 2L+1T Credits: 2

1. Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.
2. Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.
3. Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.
4. Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.
5. Numerical solution of Algebraic equation:
Bisection method, Regula-Falsi method, Newton-Raphson method.
6. Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector method and Finite Difference Method.

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar, & Jain: Numerical Methods (Problems and Solution).

Reference Books:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

Theory: MATHEMATICS-III

Paper Code: M 402

Contacts: 3L+1T

Credits: 3

Module I: Fourier Series & Fourier Transform

Topic: Fourier Series:

Sub-Topics: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave.

Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π , Fourier Series for functions of period $2l$, Dirichlet's conditions, Sum of Fourier series. Examples.

Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only). Examples.

Topic: Fourier Transform:

Sub-Topics: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions.

Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples.

Fourier Transform of Derivatives. Examples.

Convolution Theorem (statement only), Inverse of Fourier Transform, Examples.

Module II: Probability

Topic: Basic Probability Theory

Sub-Topics: Classical definition and its limitations. Axiomatic definition.

Some elementary deduction: i) $P(O)=0$, ii) $0 \leq P(A) \leq 1$, iii) $P(A')=1-P(A)$ etc. where the symbols have their usual meanings.

Frequency interpretation of probability.

Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems. Conditional probability & Independent events. Extension to more than 2 events (pairwise & mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems.

Topic: Random Variable & Probability Distributions. Expectation.

Sub-Topics: Definition of random variable. Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof). Examples.

Definitions of Expectation & Variance, properties & examples.

Some important discrete distributions: Binomial & Poisson distributions and related problems.

Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only.

Module III: Partial Differential Equation (PDE) and Series solution of Ordinary Differential Equation (ODE)

Topic: Basic concepts of PDE.

Sub-Topics: Origin of PDE, its order and degree, concept of solution in PDE. Introduction to different methods of solution:

Separation of variables, Laplace & Fourier transform methods.

Topic: Solution of Initial Value & Boundary Value PDE's by Separation of variables, Laplace & Fourier transform methods.

Sub-Topics:

PDE I: One dimensional Wave equation.

PDE II: One dimensional Heat equation.

PDE III: Two dimensional Laplace equation.

Topic: Introduction to series solution of ODE.

Sub-Topics: Validity of the series solution of an ordinary differential equation.

General method to solve $P_0 y'' + P_1 y' + P_2 y = 0$ and related problems.

Topic: Bessel's equation.

Sub-Topics: Series solution, Bessel function, recurrence relations of Bessel's Function of first kind.

Topic: Legendre's equation.

Sub-Topics: Series solution, Legendre function, recurrence relations and orthogonality relation.

Text Books:

1. Brown J.W and Churchill R.V: Complex Variables and Applications, McGraw-Hill.
2. Das N.G.: Statistical Methods, TMH.
3. Grewal B S: Higher Engineering Mathematics, Khanna Publishers.
4. James G.: Advanced Modern Engineering Mathematics, Pearson Education.
5. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.

References:

1. Bhamra K. S.: Partial Differential Equations: An introductory treatment with applications, PHI
2. Dutta Debashis: Textbook of Engineering Mathematics, New Age International Publishers.
3. Kreyzig E.: Advanced Engineering Mathematics, John Wiley and Sons.
4. Potter M.C, Goldberg J.L and Aboufadel E.F.: Advanced Engineering Mathematics, OUP.
5. Ramana B.V.: Higher Engineering Mathematics, TMH.
6. Spiegel M.R. , Lipschutz S., John J.S., and Spellman D., : Complex Variables, TMH.

Theory: FLUID MECHANICS

Paper Code: CE-401

Contacts: 2L+1T

Credits: 2

Details of Course Content:

1. Fluid statics: Forces on plane and curved surfaces, Center of pressure. Stability of floating bodies, Metacentre.
2. Weirs and Notches: Rectangular, triangular, Cippolletti, sharp crested and broad crested weirs, submerged weirs.
3. Turbulent flow in circular pipes: Fluid friction in pipes, head loss due to friction. Darcy-Weisbach equation, Variation of friction factor with wall roughness – Moody's chart. Minor losses in pipes.
4. Water Hammer: Speed of pressure wave, slow and rapid closure, use of surge tank.

5. Steady uniform flow in open channel: Characteristics, Chezy's, Manning's and Bazin's formulae. Hydraulically efficient cross sections. Flow through channels of circular cross sections – depths for maximum velocity and discharge.
6. Varied flow through open channel: Gradually varied and rapidly varied flows. Definition, Specific Energy, Critical, Sub-critical and Super-critical flows. Channel transitions - constricted or raised bed. Establishment of critical flow, Venturi flume and Parshall flume. Definition and diagram for Specific force, Hydraulic Jump.
7. Dimensional Analysis and Model studies: Dimensions and dimensional homogeneity, Importance and use of dimensional analysis. Buckingham's Pi theorem with applications. Geometric, Kinematic and Dynamic similarity. Non Dimensional Numbers.
8. Introduction to Hydraulic Turbines: Working Principles of Pelton, Francis and Kaplan turbines.
9. Pumps: Centrifugal pumps, performance characteristic graph – design flow rate. Working principles of positive displacement pumps, gear, reciprocating and vane pumps. Hydraulic Ram.

Reference Books:

1. Fluid Mechanics, Modi & Seth Standard Book House, New Delhi
2. Fluid Mechanics, A.K.Jain Khanna Publishers, New Delhi
3. Fluid Mechanics & Machinery, H. M. Raghunath CBS Publishers, New Delhi
4. Fluid Mechanics and Fluid Machines, S. K. Som & G. Biswas Tata McGraw Hill.
5. Fluid Mechanics, Hydraulics and Fluid Machines, S. Ramamrutham Dhanpat Rai
6. Basic Fluid Mechanics, C. P. Kothandaraman & R. Rudramoorthy New Age International
- Open Channel Hydraulics Van te Chow McGraw Hill

Theory: STRUCTURAL ANALYSIS

Paper Code: CE-402

Contacts: 3L+1T

Credits: 3

Details of Course Content:

1. Review of basic concept of mechanics: Equilibrium, Free body diagram, Determinate and Indeterminate structures, Degree of indeterminacy for different types of structures: Beams, Frames, Trusses.
2. Analysis of determinate structures: Portal frames, arches, cables.
3. Strain energy: Due to axial load, bending and shear, Torsion; Castigliano's theorems, theorem of minimum potential energy, principle of virtual work, Maxwell's theorem of reciprocal deflection, Betti's law.
4. Deflection determinate structures: Moment area and Conjugate beam method, Energy methods, Unit load method for beams, Deflection of trusses and simple portal frames.

5. Influence line diagrams: Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shears.
6. Analysis of statically Indeterminate beams: Theorem of three moments, Energy methods, Force method (method of consistent deformations) [for analysis of propped cantilever, fixed beams and continuous beams (maximum two degree of indeterminacy) for simple loading cases], Analysis of two-hinged arch.
7. Analysis of statically Indeterminate structures: Moment distribution method - solution of continuous beam, effect of settlement and rotation of support, frames with or without side sway. Slope Deflection Method – Method and application in continuous beams and Frames. Approximate method of analysis of structures: Portal & Cantilever methods.

Reference Books:

1. Engineering Mechanics of Solids By E. P. Popov Pearson Education
2. Basic structural Analysis C.S. Reddy TMH
3. Statically indeterminate structures C. K. Wang McGraw-Hill
4. Elastic analysis of structures Kennedy and Madugula Harper and Row
5. Structural Analysis (Vol I & Vol II) S S BhavikattiVikas Publishing House Pvt. Ltd
6. Structural Analysis Ramammurtham
7. Structures Schodek & M. Bechhold Pearson Education

Theory: SOIL MECHANICS

Paper Code: CE-403

Contacts: 2L+1T

Credit-2

Details of Course Content:

1. Introduction: Origin & formation of Soil: Types, Typical Indian Soil, Fundamental of Soil Structure, Clay Mineralogy.
2. Physical & Index properties of soil: Weight- Volume Relationships, Insitu Density, Moisture Content, Specific Gravity, Relative Density, Atterberg's Limits, Soil Indices, consistency of soil, Particle Size Distribution of soil: Sieving, Sedimentation Analysis.
3. Identification & Classification of soil: Field identification of soil, Soil Classification: as per Unified Classification System, IS Code Recommendation, AASHTO Classification.
4. Flow through soil: Darcy's Law, Coefficient of permeability, laboratory and field determination of coefficient of permeability, Permeability for Stratified Deposits, Laplace's Equations, Flow nets, Flow through Earthen Dam, Estimation of Seepage, Uplift due to seepage.
5. Effective Stress Principles: Effective Stress, Effective pressure due to different conditions, Seepage force, Critical hydraulic gradient, Quick sand condition, Design of filters, Capillarity in soil.

6. Stress Distribution In Soil: Normal and shear stresses, Stress due to point loads, Stress beneath Line, strip & uniformly loaded circular area & rectangular area, pressure bulbs, Newmark's charts- Use for determination of stress due to arbitrarily loaded areas.
7. Compaction of soil: Principles of Compaction, IS Light & Heavy Compaction Test, Field Compaction, Various methods of field compaction and control.
8. Compressibility & Consolidation of Soil: Terzaghi's theory of one dimensional consolidation, Compressibility characteristics of soils: Compression index, Coefficient of compressibility & volume change, Coefficient of consolidation, Degree & rate of consolidation, Laboratory method of one dimensional consolidation test, Determination of consolidation parameters, Secondary consolidation.
9. Shear Strength of Soil: Basic concepts, Mohr- Columb's Theory, Laboratory Determination of soil shear parameter- Direct Shear, Tri-axial Test, Unconfined Compression, Vane Shear Test, Sensitivity & thixotropy of clay.

Reference Books:

1. Principles of Geotechnical Engineering B. M. Das Thomson Book Store.
2. Text book of Soil Mechanics & Foundation Engineering V.N.S. Murthy CBS Publisher's & Distributors.
3. Geotechnical Engineering – Principles and Practice Coduto Pearson Education.
4. Soil Mechanics Lambe & Whitman. WIE.
5. Basic & Applied Soil Mechanics Gopal Ranjan & A.S.R.Rao Willes EasternLtd.
6. SP 36 (Part I) Numerical Problems – Geotechnical Engineering Rao & Venkatramaiah University Press.

Theory: ESSENTIAL STUDIES FOR PROFESSIONALS-IV

Paper Code: GS-401

Contacts: 3L

Credits: 2

Module-1 Indian Geography

i) Physical Setting

Landforms, drainage, climate, soils and natural vegetation.

ii) Economic Base

Minerals & energy resources, aquatic resources, forest resources; irrigation, agriculture and industries; trade and commerce.

iii) Population

Growth, distribution and density; demographic characteristics.

iv) Rivers, Lakes, Indian soil, seasons

a) National parks their situation & importance

b) Density of population & Census.

c) Geography of West Bengal.

Module-2 Ecology & Biodiversity

Natural Eco system, Land & soil conservation, Bio diversity Consevation, National environmental Issues.

Module-3 Management Accounting:

Brief Concept on Accountancy, Journal, Ledger, Book keeping, balance sheet, Costing etc.

Module-4 Ethics Integrity & Aptitude

Human Interface, Types of Judgement, Theories of Ethics, Role of Family, Society, Formation of behavior.

Ref Books:

Geography:

India-Khullar,

Indian Geography Arihant.

Indian geography Times.

Ecology-Biodiversity

IGNOU material of ENVS.

Environmental studies arihant.

Ethics Integrity & Aptitude

G.Subba rao & P.N.Roy chowdhury

PRACTICAL

Practical: NUMERICAL METHODS LAB

Paper Code: BSC(CS)492

Contacts: 2P

Credit: 1

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runge-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

Practical: FLUID MECHANICS LAB

Paper Code: CE-491

Contacts: 2P

Credits-1

1. Calibration of Venturimeter.
2. Calibration of Orifice meter.
3. Determination of the 'Coefficient of Friction (Cf)' for the given number of pipes having different cross section.
4. Perform the test required for verifying the Bernoulli's Equation.

5. Determination of critical 'Reynold's Number (Re)' for the given pipe flow.
6. Calibration of V-notch.
7. Calibration of rectangular notch.
8. Determination of efficiency of a Centrifugal pump

Practical: SOIL MECHANICS LAB I

Paper Code: CE-492

Contacts: 2P

Credits – 1

1. Field identification of different types of soil as per Indian standards [collection of field samples and identifications without laboratory testing], determination of natural moisture content.
2. Determination of specific gravity of i) Cohesion-less ii) cohesive soil
3. Determination of In-situ density by core cutter method & sand replacement method.
4. Grain size distribution of cohesion-less soil by sieving & fine grained soil by hydrometer analysis.
5. Determination of Atterberg's limits (liquid limit, plastic limit & shrinkage limit).
6. Determination of co-efficient of permeability by constant head permeameter (coarse grained soil) & variable head parameter (fine grained soil).
7. Determination of compaction characteristics of soil.

Practical: SKILL DEVELOPMENT FOR PROFESSIONALS-IV

Paper Code: GS-481

Contacts: 2P

Credits: 1

Module-1 Quantitative Numerical Aptitude -4 (advance)

- 1) Permutation & Combination.
- 2) Probability- basic concepts of probability, different theorems & applications, binomial, poisson & normal Distributions.
- 3) Geometry- Concept of different shapes like triangle, quadrilateral, rectangle, square, circle etc. different theorems & their applications.
- 4) Mensuration- Formulae on triangles, square, Rhombus, parallelogram, sphere, circle, cone, pyramid etc, Application based problem solving. Coordinate Geometry- Locus, Straight lines, Circle etc.

Module-2 Advance Mathematics-1(basics)

Linear Algebra: Matrix algebra; Systems of linear equations; Eigen values and Eigen vectors. Calculus: Functions of single variable; Limit, continuity and differentiability; Mean value theorems, local maxima and minima, Taylor and Maclaurin series; Evaluation of definite and indefinite integrals, application of definite integral to obtain area and volume; Partial derivatives; Total derivative; Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

Ref

Books:

Quant

Fastrack objective Arithmetic: Arihant

Quantitative aptitude for Competitive exam (4th Edition): TATA Mc Graw

Hill Quantitative aptitude for Competitive exam (3rd Edition): PEARSON

Engineering mathematics-Pearson

GATE Mathematics- Willey/McGraw hill Wiley GATE 2017 Civil engineering

Theory: ECONOMICS FOR ENGINEERS

Paper Code: HU-501

Contracts: 3L

Credits- 3

Details of Course Content:

Module-I

1. Economic Decisions Making – Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.

Module-II

3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.
4. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.

Module-III

5. Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.

Module-IV

8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And

Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.

9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.
10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Text Books:

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill.
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP.
3. John A. White, Kenneth E.Case,David B.Pratt : Principle of Engineering Economic Analysis, John Wiley.
4. Sullivan and Wicks: Engineering Economy, Pearson.
5. R.Paneer Seelvan: Engineering Economics, PHI.
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub.

The hours allotted are lecture hours, the tutorial classes should be held accordingly to contact hours allotted subject wise.

Theory: FOUNDATION ENGINEERING

Paper Code: CE-501

Contact: 3L + 1T

Credits: 4

Details of Course Content:

1. Earth pressure theories: Plastic equilibrium of soil, Earth pressure at rest, Active & passive earth pressure, Rankine's & Coulomb's earth pressure theories, wedge method of analysis, estimation of earth pressure by graphical construction (Culmann Method).
2. **Retaining wall & sheet pile structures:** Proportions of retaining walls, stability checks, cantilever and anchored sheet piles, free earth and fixed earth method of analysis of anchored bulk heads.
3. **Stability of slopes:** Analysis of finite and infinite slopes, Swedish And friction circle method, Taylor's stability number, Bishop's method of stability analysis.
4. **Site investigation & soil exploration:** Planning of sub-surface exploration, methods, sampling, samples, Insitu tests: SPT, SCPT, DCPT, Field vane shear, Plate load test.
5. **Shallow foundations :** Safe bearing capacity, Terzaghi's bearing capacity theory, effect of depth of embedment, water table, eccentricity of load, foundation shape on bearing capacity, Bearing capacity as per IS 6403.
6. **Settlement analysis of shallow foundation:** Immediate and consolidation settlement,

correction for rigidity and dimensional effects, settlement in various types of soil, IS-1904 and 8009 recommendations, Allowable bearing capacity.

7. **Deep foundations:** Pile: Types, load transfer mechanism, Determination of load carrying capacities of piles by static and Dynamic formulae, Recommendations of IS 2911, Pile group: Group efficiency, Negative skin friction, pile load test.

Text & References

1. Principles of Geotechnical Engineering B.M. Das Thomson
2. Principles of soil Mechanics & Foundation Engineering VNS Moorthy UBS Publication
3. Principles of Foundation Engineering B.M. Das Thomson
4. Foundation Analysis & Design J.E. Bowels Mc Graw Hill
5. Basic & Applied Soil Mechanics Gopal Ranjan & A.S.R. Rao Wiley Eastern Ltd
6. SP-36 (Part-I & Part-II)
7. Relevant latest IS Codes (IS 6403, IS 1904, IS 8009, IS 2911) Bureau of Indian Standard

Theory: DESIGN OF RC STRUCTURES

Paper Code: CE-502

Contact: 3L + 1T

Credits: 4

Details of Course Content:

1. **Introduction:** Principles of design of reinforced concrete members - Working stress and Limit State method of design.
2. **Working stress method of design:** Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces - Balanced, under reinforced and overreinforced beam/ slab sections; design of singly and doubly reinforced sections.
3. **Limit state method of design:** Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces; concepts of bond stress and development length; Use of 'design aids for reinforced concrete' (SP:16).
4. Analysis, design and detailing of singly reinforced rectangular, 'T', 'L' and doubly reinforced beam sections by limit state method..
5. Design and detailing of one-way and two-way slab panels as per IS code provisions.
6. Design and detailing of continuous beams and slabs as per IS code provisions.
7. **Staircases:** Types; Design and detailing of reinforced concrete doglegged staircase.
8. Design and detailing of reinforced concrete short columns of rectangular and circular crosssections under axial load.
9. Design of short columns subjected to axial load with moments (uniaxial and biaxial bending) – using SP 16.
10. **Shallow foundations:** Types; Design and detailing of reinforced concrete isolated square and rectangular footing for columns as per IS code provisions by limit state method.

Limit state method should be followed for serial number 4 to 9 as above as per IS 456 – 2000.

Text & References:

1. IS: 456- 2000 —Indian Standard for Plain and reinforced concrete – code of practice Bureau of Indian Standard
2. SP:16 Design Aid to IS 456
3. Reinforced Concrete Design by Pillai and Menon TMH
4. Reinforced concrete Limit state design Ashok K. Jain
5. Reinforced concrete S.N.Sinha TMH
6. Fundamentals of reinforced concrete N.C.Sinha and S.K. Roy S.Chand &Co
7. Limit State Design of Reinforced Concrete P. C. Varghese PHI
8. Reinforced Concrete S. K. Mallick and A. P. Gupta Oxford IBH

Theory: CONCRETE TECHNOLOGY

Paper Code: CE-503

Contact: 3L

Credits: 3

Details of Course Content

1. Concrete as a Structural Material, Chemical Composition of Cement, Hydration of Cement, Heat of Hydration and Strength, Tests on Cement and Cement Paste – fineness, consistency, setting time, soundness, strength, Quality of Water – Mixing Water, Curing Water, Harmful Contents
2. Types of Portland Cement – ordinary, Rapid hardening, low-heat, sulphate resisting, Portland slag, Portland pozzolana, super sulphated cement, white cement
3. Aggregates – Classification, Mechanical and Physical Properties, Deleterious Substances, Alkali- Aggregate Reaction, Sieve Analysis, Grading Curves, Fineness modules, Grading Requirements. Testing of Aggregates – Flakiness, Elongation Tests, Aggregate Crushing Value, Ten Percent Fines Value, Impact Value, Abrasion Value
4. Properties of Fresh Concrete – Workability, Factors Affecting Workability, Slump Test Compacting Factor Test, Flow Table Test, Segregation, Bleeding, Setting Time, Mixing and Vibration of Concrete, Mixers and Vibrators, Curing methods, Maturity.
5. Strength of Concrete – Water/Cement ratio, Gel/Space ratio, Strength in Tension, Compression, Effect of Age on Strength, Relation between Compressive and Tensile Strength, Fatigue Strength, Stress Strain Relation and Modulus of Elasticity, Poisson's

Ratio, Shrinkage and Creep, Compression Test on Cubes, Cylinders, Introduction to Non-Destructive Tests (Rebound hammer & Ultrasonic pulse velocity)

6. Admixtures – different types, effects, uses, Retarders and Super plasticizers. Mix Design by I.S. 20262 (2009). Light-weight, Polymer and Fibre-reinforced concrete.

Text & References:

1. Concrete Technology Neville Pearson Education
2. Concrete Technology M.S. Shetty S.Chand
3. Concrete Technology A. R. Santakumar OXFORD University Press
4. Concrete Technology M.L. Gambhir Tata McGraw Hill
5. Text book of Concrete Technology P.D. Kulkarni Tata McGraw Hill

Theory: ENGINEERING GEOLOGY

Paper Code: CE-504

Contacts: 3L

Credits- 3

Details of Course Content

1. **Geology and its importance in Civil Engineering.**
2. **Mineralogy:** Definition, internal and external structure of minerals, study of crystals, Classification and physical properties of minerals.
3. **Classification of rocks:** Igneous rocks: Origin, mode of occurrence, forms & texture, classification and engineering importance. Sedimentary rocks: Process of sedimentation, classification and engineering importance. Metamorphic rocks: Agents and types of metamorphism, classification and engineering importance.
4. **Weathering of rocks:** Agents and kinds of weathering, soil formation & classification based on origin.
5. **Geological work of rivers:** Origin and stages in the system, erosion, transportation and deposition.
6. **Structural geology:** Introduction to structural elements of rocks, dip & strike, definition, description, classification of folds, faults and joints, importance of geological structures in Civil Engineering.
7. **Earthquakes and seismic hazards:** Causes and effects, seismic waves and seismographs, Mercalli's intensity scale and Richter's scale of magnitude.
8. **Engineering properties of rocks:** Porosity, permeability, compressive strength, tensile strength and abrasive resistance.
9. **Rocks as construction materials:** Qualities required for building and ornamental stones, foundations, concrete aggregate, railway ballast, road metal, pavement, flooring and roofing.
10. **Geophysical exploration:** Methods of Geophysical Exploration, electrical resistivity method field procedure – sounding and profiling, electrode configuration, and

interpretation of resistivity data. Geophysical surveys in ground water and other Civil Engg. Projects.

11. Applied Geology: Surface and subsurface geological and geophysical investigations in major Civil Engg. Projects. Geological studies of Dams and reservoir sites, Geological studies for selection of tunnels and underground excavations.

12. Landslides: Types of landslides, causes, effects and prevention of landslides.

Text & References:

1. Engineering and General Geology Parvin Singh Katson publishing house Delhi 1987
2. Engineering Geology for Civil Engineers D. Venkat Reddy, Oxford, IBH, 1995
3. Principles of petrology Tyrell Asia, Bombay
4. Structural Geology Marland P. Billings Wiley eastern Prentice-Hall, U.S.A.
5. Ground Water hydrology Todd D.K. John Wiley & Sons, Second edition, 1980.

Free Elective I

Theory: MICROPROCESSOR AND MICRO CONTROLLERS

Paper Code: CE-505C

Contact: 3L

Credits: 3

Details of Course Content

Module 1

Introduction to Microcomputer based system. History Evolution of Microprocessor and microcontrollers and their advantages and disadvantages.

Architecture of 8085 Microprocessor. Address/ Data Bus multiplexing and demultiplexing Status and Control signal generation. Instruction set of 8085 Microprocessor. Classification of instructions, addressing modes, timing diagram of the instructions.

Assembly language programming:

Addition, Multiplication, Block Transfer, Ascending order, Descending Order, Finding largest & smallest number, Look-up table etc.

Interrupts of 8085 processor: classification of interrupts, Programming using interrupts(programming using INTR is not required).

Serial and parallel data transfer- Basic concept of serial I/O, DMA, Asynchronous and synchronous serial transmission using SID and SOD pins of 8085 Microprocessor.

Module 2

8051 architecture:

8051 microcontroller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts.

Assembly language Programming using 8051

Moving data:

External data moves, code memory read only data moves, PUSH and POP opcodes, data exchanges.

Logical operations:

Byte-level, bit-level, rotate and swap operations.

Arithmetic operations:

Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic. Jump and call instructions:

Jump and call program range, jumps, calls and subroutines, interrupts and returns.

Module 3

The 8086 microprocessor: Architecture, Pin details, memory segmentation, addressing modes, Familiarization of basic instructions, interrupts.

Assemble language programming: Addition, multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number, etc.

Module 4

Support IC chips: 8255, 8253, 8251: Block Diagram, Pin Details, Modes of operation, control word(s) format.

Interfacing of support IC chips with 8085, 8086 and 8051.

Memory interfacing with 8085, 8086 & 8051.

ADC/DAC interfacing with 8085, 8086 & 8051.

Brief introduction to PIC microcontroller (16F877): Architecture, PIN details, memory layout, etc.

Text Books:

1. Microprocessor architecture, programming and application with 8085- R. Gaonkar (Penram International) (strongly recommend)
2. The 8051 microcontroller- K. Ayala (Thomson)
3. Microprocessors & interfacing- D.V. Hall (Tata McGraw-hill)
4. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH.
5. The 8051 microcontroller and Embedded systems- Mazidi, Mazidi and McKinley (PEARSON).
6. An Introduction to Microprocessor and Applications- Krishna Kant (Macmillan)

Reference Books:

1. Microprocessors and microcontrollers- N. Senthil Kumar, M. Saravanan and Jeevanant (Oxford University Press)
2. 8086 Microprocessor- K. Ayala (Cengage learning).
3. Microprocessors- The 8086/8088, 80186/80386/80486 and the Pentium family- N.B. Bahadure (PHI).
- The 8051 microcontrollers- Uma Rao and Andhe Pallavi (PEARSON).

Theory: ESSENTIAL STUDIES FOR PROFESSIONAL-V

Paper Code: GS-501

Contacts: 3L+1T

Credits: 2

Details of Course Content

Module-1**ADVANCE PROFESSIONAL KNOWLEDGE-1****Module-1**

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Friction and its applications; Kinematics of point mass and rigid body; Centre of mass; Euler's equations of motion; Impulse-momentum; Energy methods; Principles of virtual work.

Module-2

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Theories of failures; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion,

Structural Analysis: Analysis of trusses, arches, beams, cables and frames. Stiffness and flexibility methods of structural analysis.

Construction Materials and Management: Stiffness and flexibility methods of structural analysis.

Module-3

Environmental Engineering Water and Waste Water: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, effluent discharge standards. Domestic wastewater treatment, quantity and characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.

Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

Noise Pollution: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

Module-4

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves. Plane table surveying.

Ref Books:

G.K publishers GATE Civil engineering,
Mcgraw hill GATE 2017 Civil engineering.
Wiley GATE 2017 Civil engineering.

PRACTICAL

Practical: SOIL MECHANICS LAB II

Paper Code: CE-591

Contact: 3P

Credit –2

Details of Course Content

1. Determination of compressibility characteristics of soil by Oedometer test (co-efficient of consolidation & compression Index)
2. Determination of unconfined compressive strength of soil
3. Determination of Shear parameter of soil by Direct shear test
4. Determination of undrained shear strength of soil by Vane shear test.
5. Determination of shear parameter of soil by Triaxial test (UU)
6. Standard Penetration Test
7. Expt No. 6 by large groups in the field.

Reference Books:

1. Soil testing by T.W. Lamb (John Willey)
2. SP-36 (Part-I & Part –II)
3. Soil Mechanics Laboratory Manual by B. M. Das, OXFORD UNIVERSITY PRESS
4. Measurement of engineering properties of soil by E.Jaibaba Reddy & K. Ramasastri.

Practical: CONCRETE LABORATORY

Paper Code: CE-592

Contact: 3P

Credits: 2

Details of Course Content

1. Tests on cement – specific gravity, fineness, soundness, normal consistency, setting time, compressive strength on cement mortar cubes
2. Tests on fine aggregate – specific gravity, bulking, sieve analysis, fineness modulus, moisture content , bulk density and deleterious materials.
3. Tests on coarse aggregate - specific gravity, sieve analysis, fineness modulus, bulk density.
4. Tests on Fresh Concrete: Workability : Slump, Vee-Bee, Compaction factor tests
5. Hardened Concrete: Compressive strength on Cubes, Split tensile strength, Static modulus of elasticity, Flexure tests, Non destructive testing (Rebound hammer & Ultrasonic pulse velocity)
6. Mix Design of Concrete.

Reference Books:

1. Relevant latest IS codes on Aggregates, Cement & Concrete [269, 383, 2386, 10262(2009), SP23]
2. Laboratory manual of concrete testing by V.V. Sastry and M. L. Gambhir

Practical: QUANTITY SURVEYING, SPECIFICATIONS AND VALUATION**Paper Code: CE-593****Contact: 3P****Credits- 2****Details of Course Content**

1. Quantity Surveying: Types of estimates, approximate estimates, items of work, unit of measurement, unit rate of payment.
2. Quantity estimate of a single storied building
3. Bar bending schedule. Details of measurement and calculation of quantities with cost, bill of quantities, abstract of quantities.
4. Estimate of quantities of road, Underground reservoir, Surface drain, Septic tank.
5. Analysis and schedule of rates: Earthwork, brick flat soling, DPC, PCC and RCC, brick work, plastering, flooring and finishing,
6. Specification of materials: Brick, cement, fine and coarse aggregates
7. Specification of works: Plain cement concrete, reinforced cement concrete, first class brickwork, cement plastering, pointing, white washing, colour washing, distempering, lime punning, painting and varnishing
8. Valuation: Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table .

Reference Books:

1. Estimating, costing, Specification and Valuation in Civil Engineering by M..Chakroborty
2. Estimating and Costing in Civil Engineering by B.N.Dutta, USB Publishers & Distributers
3. Civil Estimating, Costing and Valuation by Agarwal / Upadhay

Practical: ENGINEERING GEOLOGY LAB**Paper Code: CE-594****Contact: 3P****Credits- 2****Details of Course Content****Experiment on**

1. Study of crystals with the help of crystal models
2. Identification of Rocks and Minerals [Hand Specimens]

3. Microscopic study of Rocks and minerals
4. Study of Geological maps, interpretation of geological structures Thickness problems, Bore-hole Problems

Free Elective I Lab**Practical: MICROPROCESSOR AND MICRO CONTROLLERS LAB****Paper Code: CE-595C****Contact: 3P****Credits- 2****Details of Course Content**

1. Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical) Assignments based on above.
2. A) Familiarization with 8085 & 8051 simulator on PC.
Study of prewritten programs using basic instruction set(data transfer, Load/Store, Arithmetic, Logical) on the simulator. Assignments based on above.
3. Programming using kit and simulator for:
 - i) Table look up
 - ii) Copying a block of memory
 - iii) Shifting a block of memory
 - iv) Packing and unpacking of BCD numbers
 - v) Addition of BCD numbers
 - vi) Binary to ASCII conversion
 - vii) String Matching, Multiplication using shift and add method and Booth's Algorithm
4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly.
5. Study of timing diagram of an instruction on oscilloscope.
6. Interfacing of 8255: Keyboard and Multi-digit Display with multiplexing using 8255.
7. Study of 8051 Micro controller kit and writing programs as mentioned in S/L3. Write programs to interface of Keyboard, DAC and ADC using the kit.
8. Serial communication between two trainer kits.

Total 30hours (10 classes each of 3 periods)**Practical: SKILL DEVELOPMENT FOR PROFESSIONALS-V****Paper Code:GS-581****Contacts: 2L+1T****Credits: 1****Details of Course Content**

Module-1**ADVANCE MATHEMATICS-2:**

Ordinary Differential Equation: First order (linear and non-linear) equations; higher order linear equations with constant coefficients; Euler-Cauchy equations; Laplace transform and its application in solving linear ODEs; initial and boundary value problems

Partial Differential Equation (PDE): Fourier series; separation of variables; solutions of onedimensional diffusion equation; first and second order one-dimensional wave equation and twodimensional Laplace equation.

Module-2

Probability and Statistics: Definitions of probability and sampling theorems; Conditional probability; Discrete Random variables: Poisson and Binomial distributions; Continuous random variables: normal and exponential distributions; Descriptive statistics - Mean, median, mode and standard deviation; Hypothesis testing.

Numerical Methods: Accuracy and precision; error analysis. Numerical solutions of linear and nonlinear algebraic equations; Least square approximation, Newton's and Lagrange polynomials, numerical differentiation, Integration by trapezoidal and Simpson's rule, single and multi-step methods for first order differential equations.

Module-3**5 Mock Tests on the syllabus of Aptitude Tests.****Ref Books-**

1. Fastrack objective Arithmetic: Arihant
2. Quantitative aptitude for Competitive exam (4th Edition): TATA Mc Graw Hill
3. Quantitative aptitude for Competitive exam (3rd Edition): PEARSON
4. Engineering mathematics-Pearson
5. GATE Mathematics- Willey/McGraw hill

THIRD YEAR SIXTH SEMESTER**THEORY****Theory: PRINCIPLES OF MANAGEMENT****Paper Code: HU-601****Contact: 2L****Credits: 2****Details of Course Content****Module-I**

1. Basic concepts of management: Definition – Essence, Functions, Roles, Level
2. Functions of Management: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organisation Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organisational Effectiveness.

Module-II

3. Management and Society – Concept, External Environment, CSR, Corporate Governance, Ethical Standards.

4. People Management – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management.
5. Managerial Competencies – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

Module-III

6. Leadership: Concept, Nature, Styles.
7. Decision making: Concept, Nature, Process, Tools & techniques.
8. Economic, Financial & Quantitative Analysis – Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.

Module-IV

9. Customer Management – Market Planning & Research, Marketing Mix, Advertising & Brand Management.
10. Operations & Technology Management – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

Text Books:

1. Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP).
2. Essentials of Management – Koontz, Revised edition, Tata McGraw Hill (TMH)
3. Management – Stoner, James A. F. (Pearson)
4. Management - Ghuman, Tata McGraw Hill(TMh)

Theory: HIGHWAY AND TRANSPORTATION ENGINEERING

Paper Code: CE-601

Contact: 3L

Credits: 3

Details of Course Content

1. **Introduction to Highway Engineering:** Scope of highway engineering; Jayakar Committee Report; saturation system; highway financing ('pay as you go method and credit financing method) and highway economics (quantifiable and non quantifiable benefits to highway users, cost of vehicle operation, annual cost method, and benefit-cost ratio method).
2. **Highway Alignment: Requirements:** factors controlling alignment; engineering surveys for highway alignment and location.
3. **Highway Geometric Design:** Cross-sectional elements; design speed, passing and non-passing sight distances; PIEV theory, requirements and design principles of horizontal alignment including radius of curvature, super elevation, extra-widening,

design of transition curves, curve resistance, set back distance, grade compensation and vertical alignment.

4. **Pavement design:** Evaluation of soil subgrade, sub-base, base and wearing courses; design factors for pavement thickness (including design wheel load and ESWL, strength of pavement materials and plate load tests, and effect of climatic variations) Group Index and CBR, IRC method of flexible pavement design; Westergaards analysis of wheel load stresses in rigid pavements; frictional stresses and warping stresses; IRC recommendations for design of rigid pavements; design of expansion and contraction joints. Benkelmen Beam Test, Failure of flexible and rigid pavements.
5. **Pavement construction Technique:** Types of pavement; construction of earth roads, gravel roads, WBM, bitumen and cement concrete roads; joints in cement concrete pavements.
6. **Traffic Engineering:** Traffic characteristics, theory of traffic flow, intersection design, traffic sign and signal design, highway capacity.
7. **Road Materials and Testing :** Soil, Stone Aggregate, Bitumen, Marshall Stability Test
**** ** To be covered in CE 691 (Highway and Transportation Engineering Lab)**

Text & References:

1. High Way Engineering Khanna & Justo Nemchand & Brothers, Roorkee
2. Principles of Transportation Engineering P. Chakraborty & A. Das PHI
3. Transportation Engineering- C.J Khisty & B.K Lall.
4. I.S Specifications on Concrete , Aggregate & Bitumen Bureau of Indian Standard
5. Relevant latest IRC Codes (IRC-37 – 2001, IRC 58 – 2002, IRC 73 - 1980, IRC 86 - - 1983, IRC 106 – 1990, IRC 64 – 1990, IRC 15- 2002 Indian Road Congress

Theory: DESIGN OF STEEL STRUCTURE

Paper Code: CE-602

Contact: 3L

Credits: 3

Details of Course Content

1. Materials and Specification :-Rolled steel section, types of structural steel , specifications.
2. Structure connections: Riveted, welded and bolted including High strength friction grip bolted joints. – types of riveted & bolted joints, assumptions, failure of joints ,efficiency of joints, design of bolted, riveted & welded joints for axial load. Eccentric connection:- Riveted & bolted joints subjected to torsion & shear, tension & shear, design of riveted, bolted & welded connection.
3. Tension members: Design of tension members, I.S code provisions. Permissible stresses, Design rules, Examples.
4. Compression members: Effective lengths about major & minor principal axes, I.S code provisions. Permissible stresses, Design rules, Design of one component, two

- components and built up compression members under axial load. Examples. Built up columns under eccentric loading: Design of lacing and batten plates, Different types of Column Bases- Slab Base, Gusseted Base, Connection details.
5. Beams: Permissible stresses in bending, compression and tension. Design of rolled steel sections, plated beams. simple Beam end connections, beam -Column connections. I.S code provisions.
 6. Plate girders: Design of webs & flanges, Concepts of curtailment of flanges – Riveted & welded web stiffeners, web flange splices - Riveted, welded& bolted.
 7. Gantry Girder: Design gantry girder considering lateral buckling – I.S code provisions.

Text & References:

1. Design of Steel structures N. Subramanian Oxford University Press
2. Design Of Steel Structures - S.K.Duggal Tata Mc-Graw Hill , New Delhi New Delhi
3. Design of steel structures A.S.Arya and J.L.Ajmani Nemchand& Bros.,
4. Design of steel structures, Vol. I & II Ramachandra
5. Design of steel structures PasalaDayaratnam – A.H.Wheeler& Co Ltd. 1990
6. Design of steel structures B.S.Krishnamachar and D.AjithaSinha – Tata McGraw – Hill publishing Co. Delhi.
7. Design of steel structures Ramamurtham
8. IS 800 – 2007(Latest Revised code) Bureau of Indian Standard
9. S.P.: 6(1) – 1964 Structural Steel Sections Bureau of Indian Standard

Theory: CONSTRUCTION PLANNING AND MANAGEMENT

Paper Code: CE-603

Contact: 3L

Credits: 3

Details of Course Content

1. **Planning:** General consideration, Definition of aspect, prospect, roominess, grouping, circulation privacy, acclusion.
2. **Regulation and Bye laws :** Bye Laws in respect of side space, Back and front space, Covered areas, height of building etc., Lavatory blocks , ventilation, Requirements for stairs, lifts in public assembly building, offices.
3. **Fire Protection:** Fire fighting arrangements in public assembly buildings, planning , offices, auditorium.
4. **Construction plants & Equipment:** Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses.Plants &Equipment for concrete construction: Batching plants, Ready Mix Concrete, concretemixers, Vibrators etc., quality control.
5. **Planning &Scheduling of constructions Projects:** Planning by CPM &PERT,Preparation of network, Determination of slacks or floats. Critical activities.

- Critical path, project duration .expected mean time , probability of completion of project, Estimation of critical path, problems.
- 6. Management:** Professional practice, Defination, Rights and responsibilities of owner, engineer, Contractors, types of contract.
 - 7. Departmental Procedures:** Administration, Technical and financial sanction, operation of PWD, Tenders and its notification, EMD and SD, Acceptance of tenders, Arbitration.
 - 8. Introduction to Building Information Modeling (BIM):** Discussions of the Roles and Impacts of BIM in the Design, Construction Engineering and Management, Infrastructure Engineering, and Facility Management; Revit Architecture, Structure, and MEP; Creating Sets, Building Elements, Structural Systems, and MEP Systems; BIM and Clash Detection; BIM and Construction Cost Estimating and Scheduling; Future of Building Information Modeling.
 - 9. * Serial 1, 2, 3 are as per National Building Code**
- Text & References:**
1. Construction Planning, Equipments and methods Puerifoy, R.L. McGraw Hill.
 2. Management in construction industry P.P.Dharwadkar Oxford and IBH Publishing company New Delhi
 3. Construction Management, Critical path Methods in Construction, J.O.Brien Wiley Interscience
 4. PERT and CPM L.S. Srinath
 5. Project planning and control with PERT and CPM Construction equipments and its management B.C.Punmia and K.K.Kandelwal S.C.Sharma
 6. National Building code BIS
 7. Eastman, C., Teicholz, P., Sacks, R., & Liston, C. (2011). BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors. John Wiley & Sons.
 8. Hardin, B., & McCool, D. (2015). BIM and construction management: proven tools, methods, and workflows, John Wiley & Sons.

Professional Elective I

Theory: BRIDGE ENGINEERING

Paper Code : CE-604A

Contact : 3L

Credits :3

Details of Course Content

1. **Introduction**, - Definition and Basic Forms, Component of bridge, classification of bridge, short history of bridge development. I.R.C Loads. Analysis of IRC Loads,

- Impact factors, Other loads to be considered, Importance of Hydraulic factors in Bridge Design.
2. **Reinforced concrete solid slab bridge:** Introduction, General design features, Effective width method. Simply supported and cantilever Slab Bridge, analysis and design.
 3. **Box Culvert:** Introduction, Design method and Design example.
 4. **Beam and Slab Bridges** Introduction, Design of interior panel of slab. Pigeauds method, Design of longitudinal girder, Calculation of longitudinal moment, design example.
 5. **Balanced Cantilever Bridges:** General Features, Arrangement of supports, design features Articulation, Design example.
 6. **Steel Bridges:** General features, types of stress, Design example.
 7. **Plate Girder Bridge:** Elements, design, lateral bracing, Box- girder Bridges.
 8. **Composite Bridges:** General aspects, method of construction, analysis of composite section, shear connectors, design of composite beam.
 9. **Cable Stayed Bridge:** General features, Philosophy of design.

References:

1. Principle & Practice of Bridge Engineering S.P. Bindra– Dhanpat Rai Pub
2. Essentials of bridge engineering D.J. Victor
3. Bridge engineering Ponnuswamy
4. Design of Bridge Structures T.R. Jagadesh, M.A. Jayaram
5. Bridge engineering by Krishnaraju
6. Design of concrete bridges by Aswani, Vizirani , Ratwani
7. Design of steel structures Arya&Ajmani
8. Concrete Structures Vaziram&Ratwani
9. Structures design and drawing Krishnamurthy
10. Relevant IS & IRC codes

Theory: PRESTRESSED CONCRETE

Paper Code: CE-604B

Contact:– 3L

Credits:3

Details of Course Content:

1. **Introduction of Prestressed concrete:** Materials, prestressing system, analysis of prestress and bending stress, losses Shear and torsional resistance: design of shear reinforcement, design of reinforcement for torsion shear and bending. Deflections of prestressed concrete members: Importance, factors, short term and long term deflection.

2. **Limit state design criteria:** Inadequacy of elastic and ultimate load method, criteria for limit states, strength and serviceability. Design of sections for flexure: methods by Lin and Magnel.
3. **Anchorage Zone stresses in post tensioned members:** Stress distribution in end block, anchorage zone reinforcement.
4. **Composite construction of prestressed and in-situ concrete:** Types, analysis of stresses **Statically Indeterminate structures:** advantages of continuous member, effect of prestressing, methods of achieving continuity and method of analysis of secondary moments.
5. **Prestressed concrete poles and sleepers:** Design of sections for compression and bending.
6. **Partial prestressing and non prestressed reinforcement.**

References:

1. Prestressed Concrete, Fourth Edition, N Krishna Raju McGraw Hill
2. Design of Prestressed Structures, T.Y.Lin and N.H.Burns, Wiley Eastern Ltd
3. Fundamentals of Prestressed Concrete, N.C.Sinha and S.K.Roy
4. Prestressed Concrete, S.Ramamurthan

Theory: STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING**Paper Code: CE-604C****Contact: 3L****Credits: 3****Details of Course Content**

1. **Theory of vibrations:** Degrees of freedom, Undamped single degree freedom system, Damped single degree freedom system, Natural frequency, modes of vibration, Introduction to multiple degree freedom system.
2. **Response of single degree freedom system due to harmonic loading:** Undamped harmonic excitation, Damped Harmonic excitation.
3. **Response due to Transient loading:** Duhamel's Integral, Response due to constant force, Rectangular load, Introduction to numerical evaluation of Duhamel's integral of undamped system.
4. **Elements of seismology:** Fundamentals: Elastic rebound theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc., Seismographs, Seismic zoning, Response of Simple Structural Systems.
5. **Principles of earthquake resistant design:** Terminology, General principles and Design criteria, Methods of Analysis, Equivalent lateral force method of Analysis for multistoried building as per Indian Standard Code of Practice, Introduction to Response Spectrum Method, Fundamental concepts of Ductile detailing.

References:

1. Structural Dynamics (Theory and Computation) Mario Paz. CBS Publishers and Distributor
2. Dynamics of Structure (Theory and Application to Earthquake Engineering) A.K.Chopra Pearson Education
3. Elements of Earthquake Engineering Jai Krishna, A. R. Chandrashekhar and Brijesh Chandra South Asian Publishers
4. Earthquake Resistant Design D. J. Dowrick John Wiley & Sons
5. IS 1893 (Part 1): 2002, IS 3920, IS 4326 ----- Bureau of Indian Standard
- 6.

Free Elective II

Theory: DATA SCIENCE AND DATA ANALYTICS

Paper Code: CS-605A

Contact: 3L

Credits: 3

Details of Course Content

Module I

1. **Introduction to Data Management:** Brief idea about Data Warehousing, Architecture and Data Flows, Data pre-processing before analysis, Data preparation, OLAP & OLTP, Case study.
2. **Introduction to Data Mining:** Brief idea about Data Mining, It's goals and techniques, Architecture and KDD Process, Knowledge representation methods.

Module II

3. **Statistics and Analytics:** Data Visualization, Summarize and describe data sets using a measures such as Central tendency and variability, Learn probability, Central Limit Theorem and much more to draw inferences, Case study based on R Programming.

Module III

4. **Introduction to Big Data Analytics:** Understand the basic concepts of Big Data and Hadoop as processing platforms for Big Data, Managing Big Data - Learn and Use Hadoop Ecosystem tools for data ingestion, extraction and management. Introduction to Hive.

Module IV

5. **Cloud Computing:** Introduction to Cloud Computing, types, services, applications, Security & research scope.
6. **Internet of Things:** Introduction to IOT and WSN, Basic concepts of Robotics Using Arduino & Raspberry Pi Programming.

Module V

7. **Introduction to NLP & AI:** Introduction to artificial intelligence, Brief idea about Natural Language Processing.

Module VI

8. **Basic concepts of Machine Learning:** To implement linear regression, Data classification, Data clustering - To learn how to create segments based on similarities using K-Means and Hierarchical clustering, Case study using Python.
9. **Applications of Machine Learning:** Time series, Decision trees, Support Vector Machine, Neural Networks, Case Study Using MATLAB.

Text Books:

1. "Data Mining : Concepts and Techniques" by Jiawei Han and Micheline Kamber.
2. "Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of the Human Brain" by Amit Konar.
3. "Big Data" by Anil Maheshwari
4. "Wireless Sensor Networks" by Ian F. Akyildiz & Mehmet Can Vuran
5. "Wireless Ad Hoc and Sensor Networks : Theory and Applications" by Xian Yang Li
6. "Mastering Cloud Computing : Foundations and Applications Programming" by Rajkumar Buyya
7. "Fundamentals of Neural Networks: Architectures, Algorithms and Applications" by L. Fausett

Theory: OPERATION RESEARCH

Paper Code: CE-605C

Contact: 3L

Credits: 3

Details of Course Content

Module I

Linear Programming Problems (LPP): Basic LPP and Applications; Various Components of LP Problem Formulation.

Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples.

Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.

Module II

Network Analysis: Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).

Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.

Module III

Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

Module IV

Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.

Text Books:

1. H. A. Taha, —Operations Research, Pearson
2. P. M. Karak – —Linear Programming and Theory of Games, ABS Publishing House
3. Ghosh and Chakraborty, —Linear Programming and Theory of Games, Central Book Agency
4. Ravindran, Philips and Solberg - —Operations Research, WILEY INDIA

References:

1. KantiSwaroop — —Operations Research, Sultan Chand & Sons
2. Rathindra P. Sen— —Operations Research: Algorithms and Applications, PHI
3. R. Panneerselvam - —Operations Research, PHI
4. A.M. Natarajan, P. Balasubramani and A. Tamilarasi - —Operations Research, Pearson
5. M. V. Durga Prasad – —Operations Research, CENGAGE Learning
6. J. K. Sharma - —Operations Research, Macmillan Publishing Company

Theory:ESSENTIAL STUDIES FOR PROFESSIONAL-VI

Paper Code: GS-601

Contacts: 3L+1T

Credits: 2

Details of Course Content

ADVANCE PROFESSIONAL KNOWLEDGE-2

Module-1

Displacement methods: Slope deflection and moment distribution methods; Influence lines

Module-2

Soil Mechanics: Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and quicksand condition; Compaction in laboratory and field

conditions; Onedimensional consolidation, time rate of consolidation; Mohr's circle, stress paths, effective and total shear strength parameters, characteristics of clays and sand, Soil spring analogy (dashpot diagram).

Module-3

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; Potential flow, applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.

Module-4

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines, specific speed of pumps and turbines; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow.

Ref Books:

1. G.K publishers GATE Civil engineering,
2. Mcgraw hill GATE 2017 Civil engineering
3. Wiley GATE 2017 Civil engineering

PRACTICAL

Practical: HIGHWAY ENGINEERING LAB

Paper Code: CE-691

Contact: 3P

Credits :2

Details of Course Content

Tests on highway materials – Aggregates- Impact value, Los-Angeles Abrasion value water absorption , Elongation & Flakiness Index.

Bitumen & bituminous materials: Specific gravity, penetration value, softening point, loss on heating, Flash & Fire point test.

Stripping value test

Design of B.C. & S.D.B.C. Mix

CBR Test

Marshal Stability Test Benkelman beam Test.

References:

BIS codes on Aggregates & Bituminous materials

Highway material testing(Laboratory Manual)by S.K. Khanna and CE.G. Justo

Relevant IS & I.R.C. codes.

Practical: DETAILING OF RCC AND STEEL STRUCTURES

Paper Code: CE-692

Contact :3P

Credits: 2

Details of Course Content

RCC structures

General considerations: Design principle of R.C.C. sections. Limit state method of design

Loads and stresses to be considered in the design as per I.S. code provision.

Design & detailing of a i) simply supported R.C.C Beam ii) Continuous T- Beam.

Design & Detailing of columns, isolated and combined footing

Design & detailing of a i) simply supported one way slabii) One way Continuous slab.

Design of different units: Slab, beam column, roofing and staircase from floor plan of a multistoried frame building, typical detailing of a two way floor slab.

Steel structures

Problems on general consideration and basic concepts

Discussion on different loads (i.e. wind load, Dead load, live load and others) as per

IS875 Design & drawing of the following components of a roof truss:

1. Members of the roof truss.
2. Joints of the roof truss members
3. Purlins
4. Gable bracings
5. Column with bracings
6. Column base plate
7. Column foundation

References: I.S- 456-2000, SP 34, SP 16,I.S. 875, I.S. Code 800 – 2007, Standard text books on RCC & Steel Design.

Practical: CAD LABORATORY

Paper Code: CE-693

Contact 3P

Credits: – 2

Details of Course Content

Introduction and important features of a software dealing with analysis and design of structures Analysis and design of a multistoried building using software, Preparation of

detailed drawings of different structural elements including ductility detailing RCC Slab, beam, column and footing design.

Free Elective II Lab

Practical: DATA SCIENCE AND DATA ANALYTICS LAB

Paper Code: CS-695A

Contact 3P

Credits: – 2

Details of Course Content

1. Introduction to Python
2. Machine Learning using Python
3. Data Analysis using Python
4. Introduction to R Programming
5. Statistical Computing using R
6. Programming Tools in MATLAB for Data Analysis
7. Raspberry PI Programming
8. Conceptual learning for Arduino (Robotics)
9. WSN,IoT and Cloud
10. Introductory Hive for Data Analysis

Practical: SKILL DEVELOPMENT FOR PROFESSIONALS-VI

Paper Code: GS -681

Contacts: 2L+1T

Credits: 1

Details of Course Content

Module-1

Communication Development. Personality Development.

Module-2

10 Mocks on General Studies.

Module-3

Hands on practice session.

FOURTH YEAR SEVENTH SEMESTER

THEORY

Theory: ENVIRONMENTAL ENGINEERING

Paper Code: CE-701

Contact – 3L

Credits- 3

Details of Course Content

1. Water Demand Water demands; Per capita demand; Variations in demand; Factors affecting demand; Design period; Population forecasting.
2. Sources of Water Surface water sources; ground water sources
3. Water Quality Impurities in water; Water quality parameters; Standards for potable water.
4. Conveyance of Water Hydraulic design of pressure pipes
5. Water Treatment Typical flow chart for surface and ground water treatments; Aeration, Plain sedimentation, Sedimentation with coagulation, Water Softening, Filtration, Disinfection.
6. Water Distribution Analysis of distribution network; Storage and distribution reservoirs; Capacity of reservoirs
7. Sewage and Drainage Definition of Common Terms, Quantity estimation for sanitary sewage and storm sewage.
8. Sewer Design Hydraulic design of sewers, Partial flow diagrams and Nomograms.
9. Wastewater Characteristics Physical, chemical and biological characteristics, DO, BOD and COD.
10. Wastewater Treatment Typical flow chart for wastewater treatment; Primary Treatments; Secondary Treatments: Activated Sludge Process, Trickling Filter Process, Septic Tank.

References:

1. Environmental Engineering, S.K. Garg, Khanna Publishers
2. Water Supply, Waste Disposal and Environmental Pollution Engineering, , A.K. Chatterjee Khanna Publishers.
3. Environmental Engineering, Vol. II, P. N. Modi,
4. Environmental Modelling, , Rajagopalan Oxford University Press.
5. Environmental Engineering P. V. Rowe TMH

Theory: WATER RESOURCE ENGINEERING**Paper Code: CE-702****Contact – 3L****Credits- 3****Details of Course Content**

1. Catchment area and Hydrologic cycle, water budget, world water quantities; Precipitation and Abstractions: Forms of precipitation, data analysis. Climate and water availability, Water balances, Precipitation: Forms, Classification, Variability, Measurement, Data analysis, Evaporation and its measurement, Evapotranspiration and its measurement, infiltration..
2. Measurement of rainfall – Rain gauges, Estimation of missing rainfall data, checking of consistency, Optimum number of Rain gauges. Calculation of average rainfall over

- area – different methods, Frequency analysis of rainfall intensity duration curve. Rainfall mass curve, rain-gauge networks hyetograph, Examples.
3. Evaporation, evapo-transpiration and infiltration: Processes, Factors affecting run off, estimation of run-off, rainfall run off relationships. Examples and problems, Evaporation and Evapo transpiration – Pan evaporation, empirical equations for estimating evaporation and evapo transpiration; Transpiration.
 4. Runoff: Rainfall runoff relations, time area concept, flow duration curve, mass curve, examples and numerical.
 5. Stream flow measurement: Direct and indirect methods, Examples. Stage- discharge relationships, derivations, examples and numerical.
 6. Hydrographs; characteristics: Base flow separation. Unit Hydrographs. Derivation of unit hydrographs, flow hydrograph, Unit Hydrograph (UH), its analysis, S-curve hydrograph; examples and numerical.
 7. Floods and Routing: Concepts of return period, flood frequency analysis, Gumbel's and Log-Pearson Type-III distributions, Rational method, risk, reliability, and safety factor; Hydrologic storage routing.
 8. Groundwater Hydrology: Types of aquifers and properties, Darcy's law, steady flow in a confined and unconfined aquifer (without recharge), steady flow to a well.

References

1. Engineering Hydrology K. Subramanya Tata McGraw-Hill
2. A Text Book of Hydrology- P. Jaya Ram Reddy Laxmi Publications-New Delhi
3. Hydrology & Water Resource Engineering- S.K Garg Khanna Publishers.
4. Hydrology Principles, Analysis and Design H. M. Raghunath. .
5. Hydraulics of Groundwater J. Bear McGraw-Hill
6. Water Resources Engineering Through Objective Questions K. Subramanya Tata McGraw-Hill
7. Irrigation & Water Power Engineering- B.C Purnia, S Pande- Standard Publication-New Delhi.
8. Irrigation Engineering G.L Aswa Wiley Eastern-New Delhi
9. Irrigation, Water Resource & Water Power Engineering-. Dr. P.N Modi- Standard Book House-New Delhi

Professional Elective II

Theory: ADVANCED FOUNDATION ENGINEERING

Paper Code – CE 703A

Contact – 3L

Credits- 3

Details of Course Content

- 1. Soil Exploration and Site Investigation** Planning of soil exploration programme, Field testing, Preparation of bore-log and soil investigation report Geo-physical exploration: Seismic refraction survey electrical resistivity method.
- 2. Shallow Foundations** Bearing Capacity from SPT and SCPT and Plate load Test data, Proportioning of footing based on settlement criteria. Beams on elastic foundation: Infinite beam, Finite beam, Modulus of sub-grade reaction and effecting parameters. Raft Foundation: Settlement and Bearing Capacity analysis, Analysis of flexible and rigid raft as per IS 2950.
- 3. Deep Foundations** Pile: Tension piles, Laterally loaded piles: Elastic continuum approach, Ultimate load Analysis, Deflection and maximum moment as per IS 2911, Pile load test Drilled Shaft: Construction procedures, Design Considerations, Load Carrying Capacity and settlement analysis Caissons: Types, Sinking and control.
- 4. Retaining walls and sheet pile structures** Gravity, cantilever and counter fort retaining walls: Stability checks and design Sheet Pile Structures: Cantilever sheet piling, Anchored sheet piling: Free and fixed earth support methods of Analysis, Braced Excavation.
- 5. Design of foundation for vibration control** Elements of vibration theory, Soil-springs and damping constants, dynamic soil parameters, Types of Machine foundations, General consideration in designing dynamic bases.
- 6. Foundations on expansive soils:** Problems and Remedies.

References:

1. Foundation Analysis & Design J.E. Bowels McGraw Hill
2. Principles of Foundation Engineering B.M. Das Thomson Book
3. Foundation Design Manual N. V. Nayak Dhanpat Rai Publication Pvt. Ltd
4. Foundations for Machines: Analysis and design ShamsheerPrakash, Vijay K Puri Wiley Series in Geotechnical Engineering
5. Advance Foundation Engineering N. Som & S. C. Das
6. Hand Book of Machine Foundation P. Sirinivashalu & C.V. Vaiddyanathan Tata McGraw Hill.
7. IS –1904, 6403, 8009, 2950, 2911 etc - Bureau of Indian Standard.

Theory: SOIL STABILISATION & GROUND IMPROVEMENT TECHNIQUE**Code – CE 703B****Contact – 3L****Credits- 3****Details of Course Content**

- 1. Soil Stabilization:** Introduction, Stabilization of soil with granular skeleton and soil without granular skeleton, common nomenclature of stabilized soil systems and stabilization methods, specific methods of soil stabilization: Stabilization with cement, lime fly-ash.

2. **Insitu densification:** Introduction, Compaction: methods and controls *Densification of granular soil:* Vibration at ground surface, Impact at ground surface, Vibration at depth (Vibroflotation), Impact at depth. *Densification of Cohesive Soils:* Preloading and dewatering, Design of Sand drains and Stone columns, Electrical and thermal methods.
3. **Geo-textiles:** Over view: Geotextiles as separators, reinforcement. Geotextiles in filtration and drainage, geotextiles in erosion control.
4. **Grouting:** Over view: Suspension and Solution grout, Grouting equipment and methods, Grout design and layout, Grout monitoring schemes.
5. **Soil stability:** Reinforced earth fundamentals, Soil nailing, Soil and Rock Anchors, 36 Underpinning.

References:

1. Foundation Analysis & Design J.E. Bowels McGraw Hill
2. Principles of Foundation Engineering B.M. Das Thomson Book
3. Foundation Design Manual N. V. Nayak Dhanpat Rai Publication Pvt. Ltd
4. Construction and Geotechnical methods in foundation engineering R.M. Koener McGraw Hill
5. Technology in tunnelling and dam construction A.V. Shroff. & D.L. Shah Oxford and IBH Publishing Co.Pvt.Ltd
6. Reinforced Earth T S Ingold Thoam Telford
7. Designing with Geosynthetics R M Koerner Prentice Hall.

Theory:ADVANCED HIGHWAY &TRANSPORTATION ENGINEERING**Paper Code – CE 703C****Contact – 3L****Credits- 3****Details of Course Content**

1. Traffic Engineering : Road user and vehicle characteristics; Traffic flow characteristics – Traffic Volume, Speed, Headway, Concentration and Delay; Traffic surveys & studies; Traffic estimation; Statistical applications in traffic engineering analysis; Parking; Road intersections – Basic traffic conflicts, classification of at-grade intersections, channelization, rotaries, traffic signals, signs and marking; Road Safety; Traffic System Management.
2. Transportation planning : Transportation planning at different levels; Transport Project planning – Planning studies and investigation; Elements of Urban Transportation Planning; Transport Demand Analysis; Preparation of Project Report.
3. Railway Engineering : Location surveys & alignment, Permanent way components, Gauges, Geometric Design, Points & crossings, Stations & Yards, Signalling, Track Maintenance.

4. Airport Engineering : Functional areas of airports: Runways, Taxiways, , Aprons, Terminal buildings; Classification of Airports; Airport site selection; Design of Runway, Runway orientation, Wind Rose diagram; Design of Taxiway and Terminal Building.

References:

1. Transportation Engineering Khisty and Lal PHI
2. A Text Book of Railway Engineering S.P. Arora& S.C. Saxena
3. Railway Engineering Satish Chandra Oxford University press
4. Transportation Engineering Vazirani&Chandola
5. Airport planning and Design S.K.Khanna&M.G.Arora
6. Airport Transportation Planning & Design-. Virendra Kumar &Satish Chandra Galgotia Publication Pvt. Ltd. New Delhi.

Professional Elective III

Theory:ADVANCED STRUCTURAL ANALYSIS

Code – CE 704A

Contact – 3L

Credits- 3

Details of Course Content

1. Review of analysis of indeterminate structure
Force methods: Statically indeterminate structures (method of consistent deformations; theorem of least work)
Displacement Methods: Kinematically indeterminate structures (slope-deflection method; moment distribution method).
Matrix concepts and Matrix analysis of structures: Introduction; coordinate systems; displacement and force transformation matrices.
Contra-gradient principle; element and structure stiffness matrices
Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches.
Matrix analysis of structures with axial elements: Plane Truss; Analysis by flexibility method
Space trusses: Matrix analysis of beams and grids
Flexibility method for fixed and continuous beams
Stiffness method for grids
Matrix analysis of plane and space frames
Flexibility method for plane frames
Stiffness method for space frames.
2. Theory of Elasticity : Three dimensional stress and strain analysis, stress - strain transformation, stress invariants; equilibrium and compatibility equations, boundary conditions; Two dimensional problems in Cartesian, polar and curvilinear co-

ordinates, bending of a beam, thick cylinder under pressure, complex variable, harmonic and bi-harmonic functions; Torsion of rectangular bars including hollow sections, bending problems; Energy principles, variational methods and numerical methods.

References:

1. Matrix Methods of Structural Analysis M.B. Kanchi.
2. Analysis of Structures T.S. Thandavamoorthy Oxford University Press
3. Intermediate Structural Analysis C.K. Wang Mc Graw Hill
4. Theory of Elasticity Timoshenko & Goodier McGraw-Hill

Theory:HYDRAULIC STRUCTURES**Paper Code – CE 704B****Contact – 3L****Credits- 3****Details of Course Content**

1. Diversion Head works: Necessity, Difference between weir and Barrage, Type of Weirs, Selection of site, layout and description of each part, Effects of construction of a weir on the river regime, causes of failure of weirs on permeable foundation and their remedies.
2. Theories of seepage and Design of weirs and Barrages: Failure of Hydraulic Structures Founded on Pervious foundations: i) By piping ii) By Direct uplift, Bligh's creep theory of seepage flow, Khosla's theory & concept of flownets, concept of exit gradient and critical exit gradient, Khosla's method of independent variable for determination of pressures and exit gradient for seepage below a weir or a barrage, necessary corrections, examples.
3. Hydraulic structures for canals: Canal falls – necessity, locations, types and description of Ogee fall, Trapezoidal-notch fall, Syphon well drop. Examples.
4. Cross-Drainage Works: Necessity, types, selection of a suitable type (Introduction only).
5. Dam (General): Definition, classification of Dams, factors governing selection of type of dam, selection of suitable site for a dam.
Earthen Dams: Introduction, Types of Earthen Dams, Methods of Construction, Causes of failure, Design Criteria, Determination of line of seepage or phreatic line in Earthen Dam, seepage control in Earthen Dam, Examples.
6. Gravity Dam: Definition, Typical cross- section, Forces acting on Gravity Dam, Combination of forces for design, Mode of failure and criteria for structural stability of Gravity Dams, Principal and shear stresses. Elementary profile of a Gravity Dam, Concept of High and low Gravity Dam, Examples.
Spillways: Types, Location, Essential requirements, spillway capacity. Components of spillway, Energy Dissipators, Stilling basins (Indian standard).

References

1. Irrigation Engineering and hydraulic structures. Santosh Kumar Garg Khanna Publishers.
2. Irrigation, water Resources and Water Power Engg. Dr.P.N. Modi, Standard Book House, Delhi-6
3. Water Resources Engineering Principle and practice By SatyaNarayana Murthy Challa. New Age International (P) Ltd. Publishers. New delhi,
4. Design of Small Dams. US Department of the Interior Bureau of Reclamation. McGraw Hill
5. Concrete Dams R.S. Varsney, Oxford & I & H Publishing Co. New Delhi

Free Elective III**Theory:ENGINEERING MATERIALS****Code – CE 705A****Contact – 3L****Credits- 3****Details of Course Content**

1. **Introduction:** Material Science—its importance in engineering; Classification of Materials—metals, polymers, ceramics, composites; Advanced materials—semiconductors, smart materials, nano-materials; Review atomic structure, Atomic bonding in solids—bonding forces and energies; ionic/covalent/metallic bonding.
2. **Crystal Structure:** Fundamental concepts; Unit cells; seven crystal systems; single crystal, polycrystalline and non-crystalline materials; Metallic crystal structures—FCC, atomic packing factor, BCC & HCP structures.
3. **Imperfections in Metals:** Point defects due to vacancy & impurities, alloys, solid solutions; Dislocations—linear defects, interfacial defects, grain boundaries.
4. **Phase Diagrams:** Definition and basic concepts; solubility limit; Phase equilibria, onecomponent phase diagram, binary phase diagram, interpretation of phase diagrams.
5. **Iron-carbon System:** allotropy of iron, iron-iron carbide phase diagram, properties and uses of plain carbon steel.
6. **Classification of Metals and Alloys- compositions, general properties and uses:**
 - 6.1 **Ferrous alloys:** Classification –low carbon steels, medium carbon steels, high carbon steels, stainless steels, alloy steels, tool and die steel, cast irons.
 - 6.2 **Non-ferrous alloys:** Copper & Copper alloys; Aluminum alloys; Zinc alloys; Nickel alloys; Lead & Tin alloys

7. **Mechanical Properties of Materials:** Elastic properties of materials—tensile and compressive stress and strain, stress-strain behaviour, modulus of elasticity (Young's modulus), yield strength, tensile strength, plastic deformation, true stress and strain; Ductility; Resilience; Toughness, impact tests; Hardness- Brinell, Rockwell and Vickers hardness and their testing procedures, correlation between hardness and tensile strength; Fatigue strength; Effect of temperature on tensile strength & impact properties, creep failure.
8. **Heat Treatment:** Definition and purposes; Heat treatment processes for steels—Hardening, structural change during heating and cooling, factors affecting hardening; Tempering; Austempering; Normalizing; Annealing—full annealing, spheroidising annealing, stress-relieving, recrystallisation annealing; Precipitation or Age Hardening of non-ferrous alloys.
9. **Polymers & Elastomers:** Definition; How polymers are made- polymerization; Polymer molecular structures; Thermoplastics & Thermosets; Special characteristics like low sp. gravity, optical, electrical & thermal property, decorative color, easy formability, low corrosion etc; Uses of polymers and elastomers.
10. **Ceramic Materials:** What is ceramics; common ceramic materials and their characteristics; How ceramics are made—sintering and vitrification process; Ceramic structures; Properties and applications.
11. **Composite materials:** What is composites; Polymers matrix and their applications; Metal matrix and ceramic matrix composites and their applications; How composites are made.
12. **Corrosion and Degradation of Engineering Materials:** Definition; Types of corrosion—uniform, pitting, crevice, galvanic, stress corrosion cracking and erosion; Corrosion control — material selection, environment control, proper design.
13. **Materials Selection Methodology:** Selection of material based on required properties, availability and cost of material, environmental issues.

Books Recommended

1. Materials Science and Engineering by W.D. Callister and adapted by R. Balasubramaniam, Wiley India, 2010 Ed.
2. Engineering Materials: properties and selection by Budinski & Budinski, 9th Ed., Prentice Hall India
3. Engineering Materials and Metallurgy by R.Srinivasan, 2nd Ed., Tata McGraw Hill.
4. Materials & Processes in Manufacturing by E.P.Degarmo and adapted by Black & Kosher, 10th Ed., Wiley India.
5. Materials Science and Engineering by V.Raghavan, 5th Ed., Prentice Hall India.

Theory:ELECTRICAL & ELECTRONIC MEASUREMENT

Code – CE 705B

Contact – 3L

Credits- 3**Details of Course Content****Module-I****Measurements:**

Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, Classification of errors, loading effect due to shunt and series connected instruments.

Analog meters:

General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments
Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.

Module-II**Instrument transformer:**

Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current & Potential transformer, errors.

Measurement of Power:

Principle of operation of Electrodynamic & Induction type wattmeter. Wattmeter errors.

Measurement of resistance:

Measurement of medium, low and high resistances, Megger.

Module-III**Measurement of Energy:**

Construction, theory and application of AC energy meter, testing of energy meters.

Potentiometer:

Principle of operation and application of Crompton's DC potentiometer, Polar and Coordinate type AC potentiometer. Application.

AC Bridges:

Measurement of Inductance, Capacitance and frequency by AC bridges.

Module-IV**Cathode ray oscilloscope (CRO):**

Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO.

Electronic Instruments:

Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator.

Sensors & Transducers:

Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.

Numerical Problems to be solved in the tutorial classes.

Text Books:

1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing.
3. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.

Reference Books:

1. Sensors & Transducers, D. Patranabis, PHI, 2nd edition.
2. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication.
4. Instrument transducers, H.K.P. Neubert, Oxford University press.

Theory: IRRIGATION ENGINEERING AND HYDRAULIC STRUCTURES

Code – CE 705C

Contact – 3L

Credits- 3

Details of Course Content

1. Introduction- Definition, Necessity, Scope, Benefits and ill effects of irrigation, Types of irrigation schemes, Social and environmental considerations, Irrigation development in India. Types of Irrigation systems, uses and suitability.
2. Water Requirement of Crops- Soil-water-plant relation- field capacity, wilting point, available water, consumptive use, Irrigation requirements – Net irrigation requirement, Field irrigation requirement, Gross Irrigation requirement, Soil moisture extraction pattern, Frequency of irrigation, Principal Indian crops, methods of irrigation, crop seasons.
3. Water requirements of crops: Crop period or Base period, Duty & Delta of a crop, relation between Duty & Delta, Duty at various places, flow Duty & quantity Duty, factors affecting Duty, measures for improving Duty of water.
4. Introduction to various methods of application of irrigation water, Irrigation efficiency, assessment of irrigation water.
5. Canal Irrigation: Introduction, classification of irrigation canals, Efficient section, certain important definitions, Time factor, Capacity factor, full supply co- efficient, Nominal duty, Channel losses, Examples.
6. Design of unlined alluvial channels by silt Theories: Introduction, Kennedy's theory, procedure for design of channel by Kennedy's method, Lacey's theory, concept of

- True regime Initial regime and final regime, design procedure using Lacey's theory, examples
7. Water logging and drainage: Causes, effects and prevention of waterlogging. Type of drains-open drains and closed drains (introduction only), Discharge and spacing of closed drains. Examples.
Lining of Irrigation Canals : Objectives, advantages and disadvantages of canal lining, economics and requirements of canal lining, Design of lined Canals-examples.
 8. Introduction to ground water flow, Darcy law; Wells: Definition, Types-open well or Dug well, Tube well, open well-shallow open well, deep open well, cavity formation in open wells, construction of open wells, Yield of an open well – Equilibrium pumping test, Recuperating test, examples, Tube wells – Strainer type, cavity type, slotted type. Examples.
 9. Cross-Drainage Works: Necessity, types, selection of a suitable type (Introduction only).
 10. Dam (General): Definition, classification of Dams, factors governing selection of type of dam, selection of suitable site for a dam.
 11. Earthen Dams: Introduction, Types of Earthen Dams, Methods of Construction, Causes of failure, Design Criteria, Determination of line of seepage or phreatic line in Earthen Dam, seepage control in Earthen Dam, Examples.

References

1. Irrigation Engineering and hydraulic structures. Santosh Kumar Garg Khanna Publishers.
2. Irrigation, water Resources and Water Power Engg. Dr.P.N. Modi, Standard Book House, Delhi-6
3. Water Resources Engineering Principle and practice By SatyaNarayana Murthy Challa. New Age International (P) Ltd. Publishers. New delhi,
4. Design of Small Dams. US Department of the Interior Bureau of Reclamation. McGraw Hill
5. Concrete Dams R.S. Varsney, Oxford & I & H Publishing Co. New Delhi

Theory: ESSENTIAL STUDIES FOR PROFESSIONAL -VII

Paper Code: GS -701

Contacts: 3L+1T

Credits: 2

Details of Course Content

ADVANCE PROFESSIONAL KNOWLEDGE-3

Module-1

1. **Concrete Structures:** Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete; Analysis of beam sections at transfer and service loads. Detailing for earthquake & resistant design.

2. **Foundation Engineering:** Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes - finite and infinite slopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, pressure bulbs; Shallow foundations - Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction.

Module-2

3. **Steel Structures:** Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Plastic analysis of beams and frames. Gantry girders,

Module-3

4. **Transportation Infrastructure:** Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments; Geometric design of railway track; Airport runway length, taxiway and exit taxiway design. railway track(points & crossings, sleeper density, reconnaissance survey, embankment & drainage of track, expansion).
5. **Highway Pavements:** Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in concrete pavements.

Module-4

6. **Traffic Engineering:** Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service of rural highways and urban roads.

Ref Books:

1. **G.K publishers GATE Civil engineering**
2. **Mcgraw hill GATE 2017 Civil engineering**
3. **Wiley GATE 2017 Civil engineering**

PRACTICAL**Practical: ENVIRONMENTAL ENGINEERING LAB****Paper Code: CE-791****Contact: 3P****Credit: 2****Details of Course Content**

1. Determination of turbidity for a given sample of water Physical
2. Determination of color for a given sample of water
3. Determination of solids in a given sample of water: Total Solids, Suspended Solids and Dissolved Solids
4. Determination of pH for a given sample of water Chemical
5. Determination of concentration of Chlorides in a given sample of water
6. Determination of carbonate, bi-carbonate and hydroxide alkalinity for a given sample of water
7. Determination of hardness for a given sample of water
8. Determination of concentration of Fluorides in a given sample of water
9. Determination of concentration of Iron in a given sample of water
10. Determination of the Optimum Alum Dose for a given sample of water through Jar Test
11. Determination of the Residual Chlorine in a given sample of water
12. Determination of the Chlorine Demand for a given sample of water
13. Determination of the Available Chlorine Percentage in a given sample of bleaching powder
14. Determination of amount of Dissolved Oxygen (DO) in a given sample of water
15. Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater
16. Determination of the Chemical Oxygen Demand (COD) for a given sample of wastewater
17. Determination of bacteriological quality of water: presumptive test, confirmative test and Determination of MPN Bacteriological

Practical: CIVIL ENGINEERING PRACTICE SESSIONAL**Paper Code: CE 792****Contact: 3P****Credit : 2****Details of Course Content**

1. **Foundation Engineering** Stability Analysis of Slopes, Preparation of typical soil test report, Estimation of bearing capacity and settlement of foundation from typical field

data, Structural design and detailing of isolated rectangular footing and combined footing.

2. **Water Resource Engineering** Estimation of runoff, Field capacity and permanent wilting point Construction of hydrograph & S curve, efficient section of canal, Design of lined canals, Determination of yield of wells, flood routing
3. **Environmental Engineering** Population forecasting, Analysis and design of water distribution network, Hydraulic design of sewer
4. **Transportation Engineering** Determination of highway capacity, Highway geometric design, Design of flexible and rigid pavement, Traffic Signal Design

Free Elective III Lab

Practical: MATERIAL TESTING LAB

Paper Code: CE 793A

Contact: 3P

Credit: 2

Details of Course Content

1. Impact tests: Charpy and Izod tests
2. Test for drawability of sheet metals through cupping test
3. Fatigue test of a typical sample.
4. Sample preparation and etching of ferrous and non-ferrous metals and alloys for metallographic observation
5. Experiments on heat treatment of carbon steels under different rates of cooling including quenching, and testing for the change in hardness and observing its microstructural changes through metallographic studies.
6. Observation of presence of surface/ sub-surface cracks using different non-destructive techniques, such as dye penetration (DP) test, magnaflux test, ultrasonic or eddy current test.

(At least six experiments must be conducted)

Practical: ELECTRICAL & ELECTRONICS MEASUREMENT LAB

Paper Code: CE 793B

Contact: 3P

Credit : 2

Details of Course Content

1. Instrument workshop- Observe the construction of PMMC, Dynamometer, Electrothermal and Rectifier type of instruments, Oscilloscope and Digital multimeter.
2. Calibrate moving iron and electrodynamometer type ammeter/voltmeter by potentiometer.
3. Calibrate dynamometer type wattmeter by potentiometer.

4. Calibrate AC energy meter.
5. Measurement of resistance using Kelvin double bridge.
6. Measurement of power using Instrument transformer.
7. Measurement of power in Polyphase circuits.
8. Measurement of frequency by Wien Bridge.
9. Measurement of Inductance by Anderson bridge
10. Measurement of capacitance by De Sauty Bridge.
11. Measurement of capacitance by Schering Bridge.

Practical: MANAGEMENT PRINCIPLES FOR ENGINEERS PRACTICE

Paper Code: CE 793C

Contact:3P

Credit : 2

Details of Course Content

1. Project Management Concepts: Concept and Characteristics of a Project, Importance of Project Management.
2. Project Planning: Project Evaluation, Financial Sources, Feasibility Studies.
3. Project Scheduling: Importance of Project Scheduling, Work Breakdown Structure and Organization Breakdown Structure, Scheduling Techniques – Gantt Chart and LOB,
4. Time Cost Trade-off Analysis – Optimum Project Duration.
5. Resource Allocation and Leveling.
6. Project Life Cycle.
7. Project Cost – Capital & Operating Costs, Project Life Cycle Costing, Project Cost Reduction Methods.
8. Plant & Machine Management: **CONSTRUCTION PLANTS & EQUIPMENTS:**
Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses. Plants & Equipment for concrete construction: Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control, Maintenance & hazards involved.

References

1. Gopalkrishnan P. and Rama Mmoorthy: Text Book of Project Management, Macmillan
2. Nicholas John M.: Project Management for Business and Technology – Principles and Practice, Prentice Hall India, 2nd Edn.
3. Construction Planning, Equipments and methods Puerifoy, R.L. McGraw Hill.
4. Management in construction industry P.P.Dharwadkar Oxford and IBH Publishing company New Delhi
5. Construction equipments and its management B.C.Punmia and K.K.Kandelwal S.C.Sharma

Practical: SKILL DEVELOPMENT FOR PROFESSIONALS -VII**Paper Code:GS -781****Contacts: 2L+1T****Credits: 1****Details of Course Content****Module-1**

Report writing

Essay writing

Precis Writing

Letter writing

Comprehension

Module-210 online Mocks on **Advance professional knowledge-1,2,3.****Module-3**

5 online Mocks on general aptitude.

Essay& Report writing- P.C.DAS/ P.K.DE SARKAR

FOURTH YEAR EIGHTH SEMESTER**THEORY****Theory: ORGANISATIONAL BEHAVIOUR****Paper Code:HU801A****Contacts: 2L****Credits- 2****Details of Course Content**

1. Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB.
2. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.
3. Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making.
4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.
5. Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making.
6. Communication: Communication Process, Direction of Communication, Barriers to Effective Communication.

7. Leadership: Definition, Importance, Theories of Leadership Styles.
8. Organizational Politics: Definition, Factors contributing to Political Behaviour.
9. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process.
10. Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.

References:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.
3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10th Edn.

Theory: PROJECT MANAGEMENT**Paper Code: HU801B****Contacts: 2L****Credits- 2****Details of Course Content**

1. Project Management Concepts: Concept and Characteristics of a Project, Importance of Project Management.
2. Project Planning: Project Evaluation, Financial Sources, Feasibility Studies.
3. Project Scheduling: Importance of Project Scheduling, Work Breakdown Structure and Organization Breakdown Structure, Scheduling Techniques – Gantt Chart and LOB, Network Analysis – CPM/PERT.
4. Time Cost Trade-off Analysis – Optimum Project Duration.
5. Resource Allocation and Leveling.
6. Project Life Cycle.
7. Project Cost – Capital & Operating Costs, Project Life Cycle Costing, Project Cost Reduction Methods.
8. Project Quality Management: Concept of Project Quality, TQM in Projects, Project Audit.
9. Software Project Characteristics and Management
10. IT in Projects: Overview of types of Softwares for Projects, Major Features of Project Management Softwares like MS Project, Criterion for Software Selection.

References

1. Gopalkrishnan P. and Rama Mmoorthy: Text Book of Project Management, Macmillan

2. Nicholas John M.: Project Management for Business and Technology – Principles and Practice, Prentice Hall India, 2nd Edn.
3. Levy Ferdinand K., Wiest Jerome D.: A Management Guide to PERT/CPM with GERT/PDM/DCPM and other networks, Prentice Hall India, 2nd Edn.
4. Mantel Jr., Meredith J. R., Shafer S. M., Sutton M. M., Gopalan M. R.: Project Management: Core Text Book, Wiley India, 1st Indian Edn.
5. Maylor H.: Project Management, Pearson, 3rd Edn.
6. Nagarajan K.: Project Management, New Age International Publishers, 5th Edn.
7. Kelkar. S.A, Software Project Management: A concise Study, 2nd Ed., PHI

Professional Elective IV

Theory: ENVIRONMENTAL POLLUTION AND CONTROL

Paper Code – CE 801A

Contact – 3L

Credits- 3

Details of Course Content

1. **Introduction:** Environment. Pollution, Pollution control.
2. **Air Pollution:** Air Pollutants: Types, Sources, Effects; Air Pollution Meteorology: Lapse Rate, Inversion, Plume Pattern; Air Pollution Dispersion Model: Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height.
3. **Air pollution Control:** Self cleansing properties of the environment; Dilution method; Engineered Control of Air Pollutants: Control of the particulates, Control of Gaseous Pollutants, Control of Air pollution from Automobiles.
4. **Noise Pollution:** Definition; Sound Pressure, Power and Intensity; Noise Measurement: Relationships among Pressure, Power and Intensity, Levels, Frequency Band, Decibel Addition, Measures of community Noise i.e. LN, Leq, Ldn., LNP; Sources, ; Effects; Control.
5. **Water pollution:** Pollution Characteristics of Typical Industries, Suggested Treatments.
6. **Global Environmental Issues:** Ozone Depletion, Acid Rain, Global Warming-Green House Effects.
7. **Administrative Control on Environment:** Functions of Central and State Pollution Control Boards; Environmental Clearance Process for Industries and Infrastructural Projects
8. **Environmental Laws:** Water Act, Air Act, Motor Vehicle Act.

References:

1. Introduction to Environmental Engineering and Science G. Masters, W. Ela PHI
2. Environmental Engineering: A Design Approach A. Sincero, G. Sincero PHI
3. Environmental Engineering P. V. Rowe TMH

4. Environmental Engineering, S.K . Garg, Khanna Publishers
5. Air Pollution Rao and Rao TMH
6. Water Supply, Waste Disposal and Environmental Pollution Engineering, , A.K.Chatterjee Khanna Publishers.
7. Environmental Engineering, Vol.II, P. N. Modi,
8. Environmental Modelling, , Rajagopalan Oxford University Press.

Theory: WATER RESOURCES MANAGEMENT & PLANNING

Paper Code – CE 801B

Contact – 3L

Credits- 3

Details of Course Content

1. **Planning and analysis of Water Resource Systems:** Introduction, System Analysis, Engineers and Policymakers
2. **Methods of Analysis:** Introduction, Evaluation of Time streams of Benefits and Costs. Plan formulation, Planning models and solution procedures, Lagranges Multipliers, Dynamic Programming, Recursive equations, Bellmans‘ principle of optimality. Curse of dimensionality of discrete dynamic programming. Examples.
3. **Reservoir Operation:** Sequential process, single Reservoir problem - with release as decision variable, with storage as decision variable (deterministic approach). Examples, Related Computer Programming. Multi–reservoir problems (Deterministic approach)
4. **Water Resources Planning under Uncertainty:** Introduction, probability concepts and Methods – Random variable and Distributions, Univariate probability Distributions ,properties of Random variable – Moment and Expectation (Univariate Distributions) , Moment Generating Functions, Measures of Central tendency, Measures of Dispersion, Measures of symmetry (Skewness), measures of peakedness (kurtosis), examples.
5. **Stochastic River Basin Planning Model:** Introduction, Reservoir operation, Stochastic, Dynamic programming, Operating Model, Probability Distribution of Storage volumes and Releases, examples
6. **Water quality Management:** Prediction and Simulation, Water quality Management Modeling.

References:

1. Applied Hydrology V.T. Chow
2. Hydrology Raudkivi
3. Stochastic Hydrology Jayarami Reddy
4. Water Resources Engg. M.C. Chaturvedi

5. Water Resources Systems Planning & Analysis Ddenice P Loucks, Jery R Stedinger & Douglas A Heinth Prentice Hall, Inc New Jersy.
6. Water Resources Engineering Larry W Mays John Wiley & Sons(Asia)

Theory: REMOTE SENSING AND GIS

Paper Code – CE 801C

Contact – 3L

Credits: 3

Details of Course Content

1. **Introduction:** Definition and types of remote sensing, Tacheometry (Planimetry/ altimetry), Triangulation (Frame work / adjustment), Trilateration (EDM/ Total Station), Geodetics (physical/ geometrical geodesy), Error Analysis (causes / law of weights), Numerical example.
2. **Photogrammetry:** Camera System (phototheodolite/ aircraft), Ground photograph (oblique/orthogonal streophoto), Aerial photograph (perspective scale/ flight planning), distortion (relief / tilt), Geometrix (parallax / mapping), application (topographics / interpretation), Numerical examples.
3. **Satellite survey:** Satellite Sensing (Sensors / platforms), energy sources (electromagnetic / atmospheric interaction), visual interpretation (Band width), digital processing (imageries / enhancement), data integration (multi-approach / GIS), microwave imaging (active system / radars), applications.
4. **Astronomy:** Celestial sphere (star-coordinates / transformation), field astronomy (azimuth, solar and polar method), 3D computation (local vs global), spherical trigonometry, Multilateration, Observation, Corrections in astronomy, Correlation of low, medium, remote objects, Global Positioning System.
5. **Geoinformatics:** GIS concept (Introduction/ definition), planning and management, spatial data model, database and DBMS, linking of attributes, geospatial analysis, modern trends

References:

1. Surveying (Volume 2): Duggal S.K. Tata McGraw Hill
2. Remote Sensing & GIS: Bhatta B. Oxford Univ Press
3. Geographic Information System: Tor Bern Herdgen Wiley
4. Surveying: Bannister, Raymond & Baker Pearson Education
5. Remote Sensing & Image Interpretation: Lilesand, Kiefer and Chipman Wiley
6. Surveying (Volume 2): Kanetker.&Kulkarni
7. Remote Sensing & Geographical information System Reddy M.A. (BS publication).
8. Advanced Surveying Rampal K.K.
9. Fundamantals of Geographic Information System: Demers M.N. (Wiley)

Theory: DISASTER MANAGEMENT IN CIVIL ENGINEERING

Paper Code – CE 801D

Contact – 3L

Credits: 3

Details of Course Content

- 1. Introduction to Disaster Management (DM):** Types of Disasters, Importance & Significance of DM, Climate Change and DM, DM Institutional Framework
- 2. Risk Assessment:** Risk, Vulnerability, Damage Assessment, Risk Assessment, Disaster Risk Modelling; Emerging Risks due to Development, Climate Change Adaptation, etc.
- 3. Disaster Management:** Phases, DM Institutional Framework, Incident Command System, Disaster Management Plan, Contingency Planning, Concept of Community Based Disaster Management, Community Health and Safety.
- 4. Disaster Communication:** Early Warning and Disaster Monitoring, Disaster Communication, Role of GIS and Remote Sensing in Disaster Risk Management.
- 5. Role of Civil Engineer in Disaster Management:** Tools, Techniques, Challenges and solutions for DM and Climate Change Adaptation, Do's and Don'ts before, during and after disasters.
- 6. Disaster Management Programmes:** DM Programmes and Practices and Case Studies. **Text Books:**
 1. Modh Satish, Introduction to Disaster Management, Macmillan
 2. Sinha Prabhas C., Disaster Relief: Rehabilitation and Emergency Humanitarian Assistance, SBS Publishers.
 3. Wisner Ben, Blaikie Piers, Cannon, Terry & Davis, Ian, At risk natural hazards, people's vulnerability and disasters, Routledge.
 4. Singh R.B. (Ed.), Natural Hazards and Disaster Management Vulnerability & Mitigation, Rawat Publications.
 5. Blodgett Robert & Keller Edwards, Natural Hazards: Earth's processes as hazards disasters and catastrophe, Pearson Prentice Hall

Professional Elective V

Theory: FINITE ELEMENT METHOD

Paper Code – CE 802A

Contact – 3L

Credits: 3

Details of Course Content

1. Introduction to Finite Element Analysis: Introduction, Basic Concepts of Finite Element Analysis, Steps in Finite Element Analysis, Fundamental concepts of Elasticity.
2. Finite Element Formulation Techniques: Virtual Work and Variational Principle, Galerkin Approach, Displacement Approach, Stiffness Matrix and Boundary Conditions.

3. Element properties: Concepts of shape functions: Natural Coordinates, one dimensional, Triangular, Rectangular Elements, Lagrange and Serendipity Elements Isoparametric Formulation: Isoparametric Elements, Stiffness Matrix of Isoparametric Elements, Numerical Integration: One Dimensional, Two Dimensional.
4. Formation of stiffness matrices and analysis of Truss, Continuous Beam and Simple Plane Frame.
5. FEM for two dimensional analysis: Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements, Numerical Evaluation of Element Stiffness, Computation of Stresses.
6. FEM for Plates : Introduction to Plate Bending Problems, Finite Element Analysis of Thin Plate.
7. Introduction to application of standard FEM software in civil Engineering.

References:

1. Finite Element Method with Applications in Engineering Y. Desai et. al Pearson
2. Introduction to Finite Element in Engineering Chandrapatla&Belegundu Pearson Education
3. A First Course in Finite Element Method D. L. Logan Thomson
4. Surveying: Bannister, Raymond & Baker Pearson Education
5. Concepts and Applications of Finite Element Analysis R. D. Cook et. al Wiley India
6. Finite Element Analysis – Theory and Programming C. S. Krishnamoorthy Tata Mcgraw Hill
7. Matrix, Finite Element, Computer and Structural Analysis M. Mukhopadhyay Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India
8. Finite Element Procedures K. J. Bathe PHI, New Delhi, India

Dynamics of Soils and Foundations**Code – CE 802B****Contact – 3L****Credits: 3****Details of Course Content**

1. **Introduction:** Types of Machine Foundations, General requirement of Machine foundations, Dimensional criteria, Design data, Permissible amplitude, Permissible Bearing pressure.
2. **Fundamental of vibrations:** Degrees of freedom, Natural frequency, Undamped single degree freedom system, Damped single degree freedom system, Transmissibility, Response to ground motion, Introduction to multiple degree freedom system.
3. **Dynamic properties of Soil:** Laboratory and field evaluation of soil properties as per IS codes
4. **Analysis and design of Block type Machine Foundation:** Modes of Vibrations, Methods of Dynamic Analysis, Design considerations for dynamically loaded

- foundations and constructional features; Design procedures for foundations for hammers, reciprocating engines , Vibration Isolation and damping.
5. **Liquefaction of soils:** Definition, Causes and effects of Liquefaction, Evaluation of Liquefaction potential, Mitigation of Liquefaction Hazards
 6. **Propagation of elastic waves in soils:** Mechanism of wave propagation, Body waves, Surface waves, Rayleigh waves

References:

1. Hand Book of Machine Foundation Srinivasalu & Vaidyanathan TMH
2. Dynamics of Bases and Foundations D. D. Barkan Mc-Graw Hill
3. Geotechnical Earthquake Engineering S. L. Kramer Printice Hall
4. Earthquake Resistant Design D. J. Dorwick Wiley
5. Fundamentals of Soil Dynamics & Earthquake Engineering B. B. Prasad PHI

Theory: DESIGN OF TALL BUILDINGS**Paper Code – CE 802C****Contact – 3L****Credits: 3****Details of Course Content**

1. **Introduction :** Necessity of Tall Buildings, Design Philosophy, Strength and Stability, Creep, Shrinkage and Temperature Effects, Fire, Foundation Settlement and Soil-Structure Interaction
2. **Loadings :** Gravity loading, Wind loading, Earthquake Loading, Combination of Loadings
3. **Structural Forms :** Braced-Frame Structures, Rigid Frame Structures, Infilled-Frame Structures, Shear Wall Structures, Wall Frame Structures, Tubular Structures, Core Structures, Floor Systems – Reinforced Concrete : One-Way slab, Two-way slab, Floor Systems – Steel Framing, One-way Beam System, Two-Way Beam System, Three-Way Beam System, Composite Steel-Concrete Floor Systems
4. **Modelling for Analysis :** Approaches to analysis, Highrise behaviour, Modeling for approximate analysis, Modelling for Accurate Analysis
5. Stability of High-rise buildings, Buckling analysis of Frames
6. **Dynamic Analysis :** Dynamic Response to Wind Loading, Dynamic Response to Earthquake Loading

*The objective of this course is to introduce basic principles and design philosophy of tall buildings. Detail analytical treatment is not required.

References:

1. Tall Building Structures: Analysis and Design Bryan S. Smith and Alex Coull John Wiley & Sons, Inc, New York, 1991
2. Designing Tall Buildings Mark Sarkisian, Routledge, New York, 2012
3. Structural Frameworks Clyde T. Morris and Samuel T. Carpenter John Wiley

Theory: PAVEMENT DESIGN**Paper Code – CE 802D****Contact – 3L****Credits: 3****Details of Course Content**

1. Principles of Pavement Design : Types of Pavements, Concept of pavement performance, Structural and functional failure of pavement, Different types of pavement performance, Different pavement design approaches.
2. Traffic Consideration in Pavement Design : Vehicle types, Axle configurations, Contact shapes and contact stress distribution, Concept of standard axle load, Vehicle damage factor, Axle load surveys, Estimation of design traffic
3. Pavement Material Characterization : Identification of different type of materials Field and laboratory methods for characterization of pavement materials
4. Analysis and Design of Flexible Pavements : Selection of appropriate theoretical model for flexible pavements, Analysis of different layers of flexible pavements based on linear elastic theory, Different methods of design of flexible pavements, IRC guidelines(IRC-37)
5. Analysis and Design of Rigid Pavements : Selection of appropriate theoretical models for rigid pavements, Analysis of wheel load stresses, curling, temperature differential, Critical stress combinations, Different methods of design of rigid pavements, IRC guidelines (IRC-58)
6. Pavement Overlay Designs : Overlay design as per Indian Roads Congress guidelines (IRC-81) Overlay design as per AASHTO-1993 guidelines

References :

1. Principles of Pavement Design E.J.Yoder and M.W. Witczak Wiley
2. Pavement Analysis and Design Y. H. Huang Prentice- Hall
3. Highway Engineering Khanna and Justo Nem Chand
4. IRC-37, IRC-58, IRC-73, IRC-81, IRC-106 and other relevant IRC codes Indian Roads Congress

Practical: ESSENTIAL STUDIES FOR PROFESSIONAL-VIII**Paper Code: GS -801****Contacts: 3L+1T****Credits: 2****Details of Course Content****Advance professional knowledge-4**

1. **1.Hydrology:** Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, flood estimation and routing, reservoir capacity, reservoir and channel routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's law.
2. **Irrigation:** Duty, delta, estimation of evapo-transpiration; Crop water requirements; Design of lined and unlined canals, head works, gravity dams and spillways; Design of weirs on permeable foundation; Types of irrigation systems, irrigation methods; Water logging and drainage; Canal regulatory works, cross-drainage structures, outlets and escapes.
3. **Photogrammetry** - scale, flying height; Remote sensing - basics, platform and sensors, visual image interpretation; Basics of Geographical information system (GIS) and Geographical Positioning system (GPS).

Ref Books:

1. G.K publishers GATE Civil engineering,
2. Mcgraw hill GATE 2017 Civil engineering
3. Wiley GATE 2017 Civil engineering

PRACTICAL

Practical: STRUCTURAL ENGINEERING DESIGN PRACTICE

Paper Code – CE 891

Contact – 6P

Credits: 4

Details of Course Content

1. Water Tanks : Beams curved in plan, Domes, Circular and Intze Tanks, Rectangular Tanks, Underground Tanks
2. Pipes, Silos & Chimneys : Reinforced concrete pipes, Bunkers and Silos, Chimneys
3. Aqueducts and Box Culverts, Concrete Bridges : Type of load, Impact Effect, Design of T-beam bridge
4. Plate Girders : Design of Web, Design of flanges, Intermediate Vertical Stiffeners, Horizontal Stiffeners, Bearing Stiffeners, Horizontal Stiffeners
5. Roof trusses : General, Roof and Side Coverings, Design Loads, Purlins, Members, End Bearings, Industrial Building Frames, Framing, Bracing, Crane Girders and Columns
6. Steel Bridges : Plate girder bridges

Practical: SKILL DEVELOPMENT FOR PROFESSIONALS -VIII

Paper Code: GS-881

Contacts: 2L+1T

Credits: 1

Details of Course Content

Module-1

16 GRAND MOCK TEST OF 200 NUMBERS.

Module-2 INDUSTRIAL KNOWLEDGE

Module-3 CURRENT AFFAIRS.

Reference Books:

1. McGraw hill general studies manual
2. Pearson General Studies Manual
3. Civil Service Chronicle
4. Competition Refresher.
5. Pratiyogita Darpan