RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2021 – 2022

CIVIL ENGINEERING

III & IV SEMESTER B.E

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A^{+}' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 60% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems & Schneider Centre of Excellence. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 65 & world ranking 578 for the year 2020.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology secured All India Rank 8th for the year 2020 for Atal Ranking of Institutions on Innovation Achievements (ARIIA), by MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 65th rank among 1143 top Engineering institutions of India for the year 2021 and is 1st amongst the Engineering colleges affiliated to VTU, Karnataka.

About the Department:

The Department of Civil Engineering was started as the third department in the institute with an intake of 60 students in the year 1971. Structural Engineering was first Post Graduate program started in the year 1984 of the institute with an intake of 10 students. The UG and PG programs have been accredited by NBA for three years 2017-2020 and 2019-2022 respectively. After obtaining the autonomous status in the year 2007, the department focused towards providing state of the art curriculum development, offering electives of the present day need and techno innovative projects. These initiatives resulted in enhanced performance of the students in terms of increase in placement, increase in the number of students writing competitive examinations and pursuing higher education in the foreign universities.

Further Department of Civil Engineering was recognized as a research centre in the year 1994 leading to PhD/MSc in Civil Engineering under Bangalore University till 1994 and later it was brought under State Technological University VTU. The research centre has attracted 30 PhD research scholars to pursue their degree from this research centre and 17 research scholars have completed PhD degree. The areas of research include Structural Engineering, Transportation Engineering, Geo-Technical Engineering, Water resources Engineering and Environmental Engineering.

The Department has close interaction with number of industries and Government agencies through R&D, and consultancy works. It also has MOU's with industries and other institutes for improved interactions and coordination with outside world.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at M. S. Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To become a premier Department to impart state-of-the-art technical knowledge and professional skills through effective learning process with research ambience to produce global quality Civil Engineers to develop sustainable society.

MISSION OF THE DEPARTMENT

To transform the young minds into employable professionals by providing contemporary technical knowledge and appropriate professional skills through suitable teaching learning process.

To provide rigorous training and acquaint the students with necessary skills and leadership qualities along with ethical values to address the complex and multi- faceted Civil Engineering Problems.

To provide opportunity to develop their potential by fostering intellectual curiosity to promote them for pursuing higher studies and research through exposure to the modern engineering tools and techno innovative projects.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Bachelor of engineering graduates of Civil Engineering program of M S Ramaiah Institute of Technology shall attain the following PEO's within three to four years of graduation.

PEO1	To perform well in Engineering profession as competent professionals using contemporary technical knowledge and professional skills. **(THEME: Perform well in Engineering profession as competent professionals)**
PEO2	To pursue higher education and show intellectual curiosity for lifelong learning. **(THEME: Higher education and lifelong learning)**
PEO3	To communicate effectively to work in multi-disciplinary environments embedded with ethical values and social responsibilities. **(THEME: Effective communication, leadership and ethical values)**

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Apply the knowledge of basic sciences, geology and environmental science along with the conceptual knowledge of engineering sciences to illustrate the process involved in planning, analysis and design of sustainable civil engineering systems.

PSO2: Conduct laboratory experiments/field investigations, and analyze/interpret the experimental results for appropriate conclusions and recommendations to a real-world civil engineering problem with a significant perspective of economy, society and environment.

PSO3: Demonstrate professional ethics and implement the principles of project management, business and public policy to lead the project execution as per the design requirement, with the state-of-the-art technology and contemporary skills.

Curriculum Course Credits Distribution

Batch 2020-24

Semester	Humanities & Social Sciences (HSS)	Basic Sciences / Lab (BS)	Engineering Sciences/ Lab (ES)	Professional Courses- Core (Hard core, soft core, Lab) (PC-C)	Professional Courses - Electives (PC-E)	Other Electives (OE)	Project Work (PW)	Internship /other activities (IS/ECA)	Total semester load
First		9	11						20
Second	2	8	10						20
Third		4	3	18					25
Fourth		7		18					25
Fifth	3			15	3	3			24
Sixth				11	6	3	4		24
Seventh	3			10	6			1	20
Eighth							14	3	17
Total	**8**	**28**	**24**	**72**	**15**	**6**	**18**	**4**	**175**

SCHEME OF TEACHING III SEMESTER

Sl. No	Subject Code	Subject	Teaching Department	Credits			
				L	T	P	Total
1.	CV 31	Engg Mathematics -III	Mathematics	3	1	0	4
2.	CV 32	Strength of Materials	Civil	3	1	0	4
3.	CV 33	Surveying	Civil	4	0	0	4
4.	CV 34	Fluid Mechanics	Civil	3	1	0	4
5.	CV 35	Environmental Engineering I	Civil	4	0	0	4
6.	CV 36	Engineering Geology	Civil	3	0	0	3
7.	CVL 37	Materials Testing Lab	Civil	*	*	1	1
8.	CVL 38	Surveying Practice Lab	Civil	*	*	1	1
			Total	**20**	**3**	**2**	**25**

L – Lecture (one hour) T - Tutorial (Two hours) P - Practical (Two hours)

Note:

1. **The Non Credit Mandatory Course, Additional Mathematics – I** is prescribed for III Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other III semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE to appear for SEE. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

Sl.No.	Course Code	Course Name	Category	Credits				Contact Hours
				L	T	P	Total	
1	AM31	Additional Mathematics - I	BSC	0	0	0	0	3

2. **AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
   Every regular student, who is admitted to the 4 year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. Incase student fail to earn the prescribed activity points; eight semester Grade Card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

SCHEME OF TEACHING IV SEMESTER

SI. No	Subject Code	Subject	Teaching Department	Credits			
				L	T	P	Total
1.	CV 41	Engg Mathematics -IV	Mathematics	3	1	0	4
2.	CV 42	Structures Analysis	Civil	3	1	0	4
3.	CV 43	Hydraulics Engineering	Civil	3	1	0	4
4.	CV 44	Transportation Engineering I	Civil	4	0	0	4
5.	CV 45	Construction Materials and Concrete Technology	Civil	4	0	0	4
6.	CV 46	Environmental Engineering II	Civil	3	0	0	3
7.	CVL 47	Engg Geology Lab	Civil	*	*	1	1
8.	CVL 48	Fluid Mechanics Lab	Civil	*	*	1	1
Total				**20**	**3**	**2**	**25**

L – Lecture (one hour) T - Tutorial (Two hours) P - Practical (Two hours)

Note:

1. **The Non Credit Mandatory Course, Additional Mathematics – II** is prescribed for IV Semester Lateral Entry Diploma students admitted to BE Program. The student shall register for this course along with other IV semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE to appear for SEE. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

Sl. No.	Course Code	Course Name	Category	Credits				Contact Hours
				L	T	P	Total	
1	AM41	Additional Mathematics - II	BSC	0	0	0	0	3

2. **AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
   Every regular student, who is admitted to the 4 year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

ENGINEERING MATHEMATICS - III

Course Code: CV 31 **Credits: 3:1:0**

Contact Hours: 42+14

Course Content

Unit I

Numerical solution of Algebraic and Transcendental equations: Method of false position, Newton - Raphson method.

Numerical solution of first order Ordinary Differential equations: Taylor's series method, Euler's, modified Euler's method and fourth order Runge-Kutta method.

Unit II

Statistics: Curve fitting by the method of least squares, Fitting linear, quadratic and geometric curves**,** Correlation and Regression analysis, Multiple correlation and regression.

Unit III

Linear Algebra I: Elementary transformations on a matrix, Echelon form of a matrix, Rank of a matrix, Consistency of system of linear equations, Gauss elimination and Gauss-Seidel method to solve system of linear equations, Eigen values and Eigen vectors of a matrix, Rayleigh's power method to determine the dominant Eigen value of a matrix, Diagonalization of square matrices, Solutions of system of ODE's using matrix method.

Unit IV

Linear Algebra II: Symmetric matrices, Orthogonal diagonalization and Quadratic forms. Vector Spaces, Linear Combination and Span, Linearly Independent and Dependent vectors, Basis and Dimension, Linear Transformations, Composition of matrix transformations, Rotation about the origin, Dilation, Contraction and Reflection, Kernel and Range, Change of basis.

Unit V

Calculus of variation: Variation of a functional, Extremal of a functional, Euler's equation, Standard variational problems, Geodesics, Minimal surface of revolution, Hanging cable and Brachistochrone problems.

Text Books:

1. Erwin Kreyszig – Advanced Engineering Mathematics-Wiley-India publishers-10th edition-2015.
2. B. S. Grewal – Higher Engineering Mathematics – Khanna Publishers – 44th edition – 2017.

References:

1. David C. Lay, Steven R. Lay, Judi. J. McDonald – Linear Algebra and its Applications – Jones and Bartlett Press – 5th edition – 2015.
2. Peter V. O'Neil – Advanced Engineering Mathematics – Thomson Brooks/Cole – 7th edition -2011

Course Outcomes (COs):

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

1. Apply numerical techniques to solve engineering problems. (PO-1,2 & PSO-1)
2. Fit a least squares curve to the given data and interpret the correlation between variables. (PO-1,2 & PSO-1)
3. Test the consistency of system of linear equations and solve ODEs by matrix method. (PO-1,2 & PSO-1)
4. Orthogonally diagonalize a given matrix and solve some application problems on linear transformation. (PO-1,2 & PSO-1)
5. Solve some variational problems and its applications. (PO-1,2 & PSO-1)

STRENGTH OF MATERIALS

Course Code: CV 32 **Credits: 3:1:0**

Contact Hours: 42+14

Course Content

Unit I

SIMPLE STRESSES AND STRAINS: Introduction, Properties of Materials, Stress, Strain, Hook's law, Poisson's Ratio, Stress - Strain Diagram for ferrous and non-ferrous metals, Principles of superposition, Total elongation of tapering bars of circular and rectangular cross sections. Elongation due to self-weight, Composite section, volumetric strains - expression for volumetric strain, Elastic constants, relationship among elastic constants, Thermal stresses.

Unit II

COMPOUND STRESSES: Introduction –State of stress at point, Stress components on inclined planes – General two-dimensional stress system - Principal planes and stresses - Mohr's Circle of stresses. Thin cylinders subjected to pressure, change in length, diameter and volume.

Unit III

SHEAR FORCE IN BEAMS: Introduction - Types of beams, supports and loadings - Shear force & Bending moment, Sign conventions - Relationship between loading, shear force and bending moment - SFD and BMD with salient values for cantilever beams, simply supported beams and overhanging beams for point loads, UDL, UVL and Couple.

Unit IV

BENDING AND SHEAR STRESS IN BEAMS: Introduction - Bending stress in beam - Assumptions in simple bending theory - Derivation of Bernoulli's equation for simple bending - Section modulus Flexural rigidity - Expression for shear stress in beam - Shear stress distribution for rectangular, 'I' and 'T' sections. - Combined Direct and Bending stresses - Behavior of circular Shaft under Torsion.

Unit V

DEFLECTION OF PRISMATIC BEAMS & ELASTIC STABILITY OF COLUMNS: Introduction - Definitions of slope, deflection - Elastic curve derivation of differential equation for flexure - Slope and deflection using Macaulay's method for simply supported and cantilever beams subjected to point loads and UDL. Elastic

stability of columns- Introduction - Short and long columns - Euler's theory on columns - Effective length slenderness ratio - radius of gyration, buckling load - Assumptions, derivations of Euler's Buckling load for different end conditions - Limitations of Euler's theory - Rankine's formula

Text Books

1. Basavarajaiah and Mahadevappa, "Strength of Materials", CBS Publishers, New Delhi.
2. R S Khurmi& N Khurmi, "Strength of Materials", S Chand Publishers, New Delhi.
3. Srinath L S, Prakash Desayi, Srinivasa Murthy N, S. AnanthaRamu, "Strength of Materials", MacMillan, India, New Delhi.
4. S. Ramamrutham and R Narayanan, "Strength of Materials", Dhanpat Rai Publishing Co Pvt Ltd

References

1. Timoshenko and Young, "Elements of Strength of Materials" Affiliated East-West Press.
2. James M. Gere, "Mechanics of Materials" - (5th Edition), Thomson Learning.
3. Beer & Johnston, "Mechanics of Materials", TATA McGraw Hill.
4. E P Popov, "Mechanics of Solids", Prentice Hall of India.

Course Outcomes (COs):

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

1. Evaluate the engineering properties of the materials and compile to analyze their structural behavior under axial loading.
2. Analyze the behavior of structural elements subjected to compound stresses.
3. Evaluate the shear and flexure forces in determinate beams for various combinations of loads and supporting conditions.
4. Analyze the bending, shear and torsional stresses across various beam sections.
5. Determine deflection in beams and stability of the compression members.

SURVEYING

Course Code: CV 33 **Credits: 4:0:0**

Contact Hours: 56

Course Content

Unit I

Introduction: Definition of surveying & Geomatics; Importance of surveying in Civil Engineering; Types of surveying- control survey, topographic survey, cadastral survey, hydrographic survey, alignment survey, mine surveying and construction survey; Surveying through the ages- chain surveying, compass surveying and plane table surveying- concepts and limitations only.

Distance Measurement: Using tapes, Hand held distance meter and distance measuring wheel. Electronic Distance Measurements (EDM) - Total station and GPS. Total station- Features and advantages.

Unit II

Leveling- Definition, terms used in leveling. Methods of determining difference of elevation- plane of collimation method using dumpy level and using total station. Longitudinal and cross sectioning using total station; Plotting of L/S and C/S using software tools. Contouring- definition, terms used, characteristics of contours and applications of contours in civil engineering practice. Contouring with total station and plotting. Theodolite surveying: Terms used in Theodolite. Features of Theodolite. Measurement of horizontal angles (method of repetition and reiteration).

Trigonometric leveling- Finding elevation using single and double plane method and Total Station. Measurement of coordinates using total station. Data collection, storage, data transferring and plotting in CAD.

Unit III

Curves –Types of Curves- Application of curves in civil engineering. Setting out curve by Theodolite (Rankine's method and using Total Station). Components of compound, Reverse curve (Between 2 parallel straights). Transition Curve.

Areas and Volumes- Methods of determining areas by trapezoidal and Simpsons' rule. Measurement of volume by prismoidal and trapezoidal formula. Earthwork volume calculations from spot levels and from contour plans; Earthwork calculation in Embankments;

Construction Surveying - Setting out works using Total Station, Setting out buildings by Centre line method.

Unit IV

Remote Sensing: Introduction, Ideal remote sensing system. Electromagnetic remote sensing- Electromagnetic energy, electromagnetic spectrum. Interaction of EMR with earth's atmosphere and earth- surface, spectral reflectance of earth surface materials (Soil, Water and Vegetation) and atmospheric Window**.**

Introduction to Digital Image processing and Interpretation: Digital image and its properties, Introduction to digital image processing (Basics of radiometric and geometric corrections, image enhancements, image transforms based on arithmetic operations, image filtering). Image interpretation keys. Introduction to Thematic classification (supervised and unsupervised) and accuracy assessment.

Unit V

Geographic Information system: Introduction to GIS. Definition of GIS, Key Components of GIS, Functions of GIS, Data structures in GIS, layer concepts, analysis of data and output. Global Positioning system- GPS satellite systems, components of GPS, positioning and relative positioning with GPS. Surveying using GPS. Applications of Remote sensing, GIS and GPS: Urban Planning, Transportation, Irrigation and Agriculture, House Utility Mapping Services, Natural resource and disaster management

Text Books

1. Surveying Vol.I, Dr. B.C.Punmia, Ashok Kumar Jain, Dr Arun Kuma Jain, Laxmi Publications, 2017, 17th edition. ISBN: 9788170088534.
2. Elementary Surveying : an introduction to geomatics by Charles D. Ghilani, 13th ed, Prentice Hall, 2012, ISBN-13: 978-0-13-255434-3.
3. Higher Surveying, by A M Chandra, New Age International, 2005, ISBN: 81:224:1628:4.
4. Lillesand T.M., and R.W. Kiefer, Remote sensing and image interpretation. 4th ed, John Wiley & Sons, 2000.
5. Jensen J.R., Introductory digital image processing: a remote sensing perspective. 2nd ed Prentice Hall, 1996.
6. K. R. Arora, Surveying Vol. I, ISBN: 9788189401238 Publisher: Standard Book House.

References

1. S.K. Duggal, (2008), Surveying – Vol I, Tata McGraw hill publishing company Ltd, New Delhi.
2. Remote Sensing and GIS, B Bhatia, Oxford University Press.
3. Surveying theory and practice, James M Anderson and Edward M Mikhail, Tata McGraw Hill Publication.
4. Kang-Tsung Chang. Introduction to Geographic Information Systems. McGraw Hill Education; 4th Edition, 2017.

Course Outcomes (COs):

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

1. Describe types of surveying through time and measure distance using different instruments.
2. Establish reduced levels, plot profile, contours, compute linear and angular measurements. Demonstrate use of theodolite and total station.
3. Compute data for curve setting and earthwork estimation.
4. Describe principles of Remote Sensing, Digital Image processing & Interpretation of satellite images.
5. Describe Geographic Information system, GPS and their applications.

FLUID MECHANICS

Course Code: CV 34 **Credits: 3:1:0**

Contact Hours: 42+14

Course Content

Unit I

Fluid Properties and Fluid Pressure: Introduction. Difference between solid and fluid; Units and dimensions. Definitions - Fluid, Continuum, Mass density, Specific weight, Specific Volume, Relative density, Compressibility and Bulk modulus of elasticity, Vapour pressure. Viscosity - Newton's law of viscosity, Classification of fluids. Surface tension and Capillarity – Pressure intensity inside a droplet, a soap bubble and a liquid jet, Equation for capillarity. Fluid Pressure – Definition, Variation of pressure in a fluid, Pascal's law, Absolute, Gauge and Negative pressures. Measurement of Pressure - Simple and Differential Manometers, Types of pressure gauges.

Unit II

Hydrostatics: Introduction. Definitions - Total Pressure and Centre of Pressure, Total pressure and Centre of pressure on plane Vertical, Inclined and Curved surfaces, Pressure diagrams, Practical applications of Total pressure and centre of pressure. Buoyancy and Flotation- Archimedes principle, Buoyant force and Centre of buoyancy, Meta centre, Stability of submerged and floating bodies.

Unit III

Fundamentals of Fluid Flow: Introduction. Continuum, Control volume, Control Surface. Hydro Kinematics - Lagrangian and Eulerian approach, Types of fluid flow. Description of fluid flow - Stream line, Path line and Streak line. Principle of Conservation of Mass - Continuity equation in Cartesian coordinates, Continuity equation for One-Dimensional flow. Incompressible flow - Stream function, velocity potential, Flow net analysis. Principle of Conservation of Energy - Euler's equation of motion, Bernoulli's equation, assumptions and limitations, Kinetic energy correction factor. Representation of various heads in pipe flow. Bernoulli's equation for real fluid. Principle of Conservation of Momentum - Impulse-momentum equation, Momentum correction factor. Force on a bend pipe. Angular momentum principle.

Unit IV

Applications of Bernoulli's Equation and Momentum Equation: Introduction, Flow Measurement in tanks- Orifices and Mouthpieces. Classification, Hydraulic Coefficients, Time taken for emptying a tank (with no inflow). Flow measurement in pipes - Venturimeter and Orifice meter. Flow measurement in open channels - Notches and Weirs. Classification, End contractions. Equation for discharge over triangular notch, Rectangular notch, Broad Crested weir, Ogee weir, Trapezoidal notch and Cipolletti weir. Velocity measurement - Pitot tube and Static pitot tube. Impact of jet

on vanes - Introduction. Force exerted by fluid jet on stationary and moving flat plates (normal & inclined).

Unit V

Viscous Flow and Flow through Pipes: Introduction. Reynolds experiment - Description of laminar flow and turbulent flow. Viscous Flow: Laminar flow - Relation between shear and pressure gradients. Boundary Layer Theory - Thickness of boundary layer, Laminar Boundary layer, Turbulent Boundary layer and Laminar sub-layer. Separation of Boundary layer. Moody's chart, Hydrodynamically smooth and rough boundaries. Losses in pipe flow - Frictional (major) loss, minor losses, Expressions for loss of energy due to friction, sudden contraction and sudden expansion. Pipes in series - Compound pipe and Equivalent pipe, Pipes in parallel, Branched pipes. Siphon. Transmission of power through pipes. Water hammer in pipes.

Text Books

1. P.N. Modi & S.M. Seth, "Hydraulics and Fluid Mechanics", Standard Book HouseC.
2. S. P. Ojha, P.N. Chandramouli, and R. Berndtsson, "Fluid Mechanics and Machinery", Oxford University Press.
3. S. K. Som & G. Biswas, "Introduction to Fluid Mechanics and Fluid Machines" Tata McGraw HILL Publishing Company Ltd.

References

1. Streeter, Wylie and Bedford, "Fluid Mechanics", Tata McGraw-Hill Edition.
2. Subramanya. K, "Fluid Mechanics Through Problems", Tata McGraw-hill Publishing Company.

Course Outcomes (COs):

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

1. Describe the fluid properties and their significance in fluid mechanics and demonstrate the skills in evaluation of fluid pressure.
2. Evaluate the hydrostatic forces acting on submerged bodies and stability analysis of floating bodies.
3. Summarise the basic principles of fluid flow.
4. Apply Principle of conservation of energy and Principle of conservation of momentum on fluid flow problems.
5. Describe laminar and turbulent flow near boundary surface and apply the concepts to analyse flow through pipes.

ENVIRONEMNTAL ENGINEERING - I

Course Code: CV 35 **Credits: 4:0:0**

Contact Hours: 56

Course Content

Unit I

Water demand and population forecasting- Need for protected water supply and Role of Engineers. Different water demands-domestic, institutional, and commercial demand, public uses, fire demand-estimation by Kuichling's formula, Freeman formula and National board of fire Underwriters formula. Per-capita consumption- factors affecting per capita demand. Variations in rate of water demand. Peak factor and design period. Population forecast-Arithmetic mean, geometric mean and incremental increase method. Concepts of safe water, wholesome water and palatable water, NBC guidelines for water requirement.

Unit II

Quality of water and intake structures – Sources of water - Classification, quantity and quality aspects. Physical, chemical and bacteriological analysis of water. Standards of Water quality desired for domestic water supplies – BIS and WHO Standards – Health significance of Fluorides, Nitrates and Heavy metals like Mercury, Cadmium, Arsenic etc. Water borne diseases. Bacterial examination of water-multiple fermentation tube and membrane filter test –MPN. Sampling- Objectives, methods, preservation techniques. Intakes, types of Intakes-Reservoir and River intake, factors governing the location of intakes, Pumps for lifting water.

Unit III

Treatment of water - Treatment of water – Objectives, Conventional treatment plant layout. Different treatment units (location and its function) - Screening, Aeration-Types of aerators, Sedimentation-Coagulant aided sedimentation-types of coagulants; chemical feeding, flash mixing. Design of circular sedimentation Tank. Theory of filtration, types of filters-rapid sand filters and pressure filters including construction, operation and cleaning.

Unit IV

Disinfection and Softening process- Disinfection- methods of disinfection, chlorination, chlorine demand, residual chlorine, use of bleaching powder. Design of filtration units. Description of Lime soda, Zeolite process, Reverse osmosis and Nano filtration membranes and elements.

Unit V

Distribution System and Building Plumbing - Different distribution systems and layouts. Storage and Distribution Reservoirs. Layout of Distribution system. Pipes- Design of the economical diameter of the rising main, Pipe fittings, and pipe joints, Testing of pipelines, Pressure test for pipe distribution. Water supply to buildings - Street connection, internal storage (sump and overhead tank). Distribution of water – Supply systems within the building (overhead tanks and Hydro pneumatic systems). Pipes & fittings used in buildings (C- PVC), different types of bib cocks & other fixtures.

Text Books

1. Garg, S.K., Environmental Engineering Vols. I, Khanna Publishers, New Delhi, New Delhi 2010.
2. Punmia B. C, and Ashok Jain, "Environmental Engineering Vol. I- Water Supply Engineering, Laxmi Publication (P) Ltd., New Delhi 2011.
3. Mark.J Hammer, Water and Waste Water Technology, John Wiley and Sons Inc., New York, 2008.

References

1. Howard. S. Peavy, Donald. R. Rowe, G. Tchobanoglous Environmental Engineering, McGraw Hill International Edition, New York 2000.
2. CPHEEO Manual on Water Supply and Treatment, Ministry of Urban Development, Government of India, New Delhi.
3. Panchadhari. A.C., "Water Supply and Sanitary Installations", New Age International Publishers, New Delhi.
4. SP 35 (1987): Handbook on Water Supply and Drainage (with Special Emphasis on Plumbing) [CED 24: Public Health Engineering.]

Course Outcomes (COs):

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

1. Forecast population and to estimate water demand for a community.
2. Evaluate the water quality and its suitability for drinking.
3. Design water treatment units to meet the water quality standards.
4. Identify suitable disinfection and softening process to meet the water quality standards.
5. Plan the distribution system and plumbing of buildings as per bye-laws.

ENGINEERING GEOLOGY

Course Code: CV 36 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Geomorphology and Geodynamics: Geology & its importance in Civil Engineering projects; Internal structure of the Earth & its composition; Weathering of rocks, Kinds of weathering, Formation of soil & its classification, Soil profile, Soil erosion & its conservation; Geological work of rivers; Concept of Plate tectonics; Landslides, Types & causes of mass movements, Geological deformation & mode of failure, Stabilizing hill-slopes; Formation of Earthquakes, Microzonation, Seismic hazard zoning, Construction of seismic resistant structures.

Unit II

Applied Mineralogy and Petrology: Physical & chemical properties in minerals, Types of minerals, Classification of minerals, Rock forming minerals: Quartz, Feldspar, Mica, Calcite etc., & Industrial forming minerals: Magnetite, Haematite, Chalcopyrite, Galena, Bauxite etc.

Introduction to Igneous, Sedimentary & Metamorphic rocks, Mode of occurrence, Classification, Structure & their importance in Civil Engineering practice such as Granite, Granite Porphyry, Diorite, Dolerite dyke, Basalt etc., Conglomerate, Sandstone, Shale, Limestone etc., Gneiss, Slate, Marble etc.

Unit III

Structural Geology & Rock masses: Outcrops, Dip & Strike; Folds, Faults, Joints & its types, Recognition of folds, faults, joints in the field & its consideration in Civil Engg projects; Selection of site for Dams & Reservoirs; Tunneling through hill barriers; Building bridge across rivers.

Engineering properties & classification of Rock masses; Rock as construction materials; Natural concrete aggregates; Laying foundations of buildings & utility structures, Critical factor, Bearing capacity, Appropriate foundation types suited to different ground conditions.

Unit IV

Rock Mechanics & Geoinformatics: Surface & subsurface explorations by Geological & Geo-Physical investigations; Different types of drilling; Ground improvement methods such as Grouting, Rock bolts, Geosynthetics.

Applications of RS & GIS techniques for Civil Engineering – Lithological discrimination & Structural mapping, Land use & land cover, Water resources studies, Geo-hazards

Unit V

Hydrogeology and Environmental Geology: Hydrological cycle; Vertical distribution of groundwater; Aquifers & its types; Geological factors for selecting a site for sinking wells and Electrical Resistivity survey for groundwater explorations; Occurrence of groundwater in various lithological formations; Groundwater provinces of India.
Quality criteria for groundwater use; Groundwater contamination & Geological condition for sanitary landfills; Artificial Recharge of Groundwater; Problems of groundwater in Civil Engineering practice; Evaluation of environmental impact of road building, Scientific methods of excavation & Debris disposal.

Text Books

1. Parbin Singh. "Text book of Engineering and General Geology", Katson publishing house, Ludhiana, 2009.
2. Mukerjee, P. K. "Text book of Geology", World Press Pvt. Ltd., Kolkatta.
3. Gokhale, K. V. G. "Principles of Engineering Geology, B S Publication, Hyderabad, 2011.
4. Venkata Reddy, D. "Engineering Geology for Civil Engineering", Oxford and IBH Publishing company, New Delhi, 1997.
5. Sathya Narayanswami, B. S. "Engineering Geology", Dhanpat Rai & Co.
6. Maruthesha Reddy, M.T. "Applied Engineering Geology", Subhas Stores, Bangalore, 2013

References

1. Tyrrell, G. W. "Principles of Petrology", Chapman & Hall Ltd, 1978.
2. Billings, M. P. "Structural Geology", Prentice Hall, 1972.
3. Todd, D. K. "Groundwater Hydrology", John Wiley & Sons, New York, 1980.
4. Anji Reddy, M. "Remote sensing and GIS", B S Publlications, 2008.
5. Karanth, K. R. "Groundwater assessment development and Management", Mc Graw Hill Education, Chennai, 2017.
6. Valdiya, K. S. "Environmental Geology", Mc Graw Hill Education, Chennai, 2017.

Course Outcomes (COs):

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

1. Describe index properties of earth dynamic & justify geological hazards.
2. Identify natural resources for mineral based industries & construction.
3. Determine rock mass properties & its suitability in engineering projects.
4. Estimate and evaluate the ground behavior & change detection through geo-informatics techniques.
5. Delineate the interactions between groundwater systems & conditions of rocks along with impacts.

MATERIALS TESTING LABORATORY

Course Code: CVL 37 **Credits: 0:0:1**

Contact Hours: 14

List of Experiments:

1. Hardness tests on ferrous and non ferrous metals
2. Tests to determine Impact energy absorbed by mild steel and aluminum samples.
3. Test to determine the mechanical properties of the ferrous metals Fe 250 and Fe 415 to 550 used for RCC subjecting it to tensile load.
4. Tests to determine the compressive strength of steel & wood.
5. Tests to determine the shear strength of steel sample.
6. Tests to determine flexural strength test of wood and demonstrate strain ageing of steel bar.
7. Tests to determine torsional strength of steel sample.
8. Tests to determine young's modulus of steel and wood by deflection equation.
9. Tests to determine the compressive strength of bricks & roof tiles.

Reference Books:

1. Timoshenko and Young, "Strength of Materials – Vol II", Von Nastrand Company, New York.
2. Laboratory Manual prepared by the Department.

Reference IS code:

IS 5652 (Part 1): 1993, IS 1500: 2005, IS 1598: 1977, IS 1757: 1988, IS 1608:2005, IS 1708 part (8-9):1986, IS 5242:1979, IS 2408:1963, IS 1786:2008, IS 1717:2012, IS 1717:2012, IS 3495 part (1-4):1992, IS 654:1992

Course Outcomes (COs):

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

1. Classify the type of engineering material based on the energy absorption capacity.
2. Demonstrate the experiments and evaluate the mechanical strength of various ductile materials.
3. Demonstrate the experiments and evaluate the mechanical strength of various brittle materials.
4. Demonstrate the experiments and evaluate the strength of various materials.
5. Summarize various properties of the materials and compile their suitability as per the provisions given in I.S code.

SURVEYING PRACTICE LABORATORY

Course Code: CVL 38 **Credits: 0:0:1**

Contact Hours: 14

List of Exercises:

1. Distance measurement- Using tapes, hand held distance meter, distance measuring wheel and Electronic Distance Measurements (EDM)
2. Angle measurement using Theodolite- Horizontal and vertical angle measurement.
3. Angle measurement using Total station – Horizontal and vertical angle measurement.
4. Leveling – finding elevation by differential leveling (Plane of collimation method)
5. Measurements of heights and distances by single and double plane method using theodolite.
6. Finding areas using total station.
7. Setting out a simple curve by deflection angle method.
8. Contouring using total station. Plotting using CAD.
9. Profile survey L/S, C/S using total station. Plotting using CAD.
10. Setting out simple curve using Total station.
11. Setting out building by centre line method.
12. Setting out sewer line using total station.

Text Books:

1. Surveying Vol.I, Dr. B.C.Punmia, Ashok Kumar Jain, DrArun Kuma Jain, Laxmi Publications, 2017, 17th edition. ISBN: 9788170088534.
2. Elementary surveying: an introduction to geomatics by Charles D. Ghilani, 13th ed, Prentice Hall, 2012, ISBN-13: 978-0-13-255434-3.
3. Higher Surveying, by A M Chandra, New Age International, 2005, ISBN: 81:224:1628:4.

Reference Books:

1. S.K. Jain, (1971), Plane and Geodetic surveying for Engineers. 6th edition, CBS Publishing and distributers, New Delhi.
2. S.K. Duggal, (2008), Surveying – Vol I, Tata McGraw hill publishing company Ltd, New Delhi.
3. Advanced Surveying: Total Station, GIS and Remote Sensingby N. Madhu, R. Sathikumar, Satheesh Gopi.

Course Outcomes (COs):

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

1. Determine distances and angles using different instruments.
2. Determine the levels of accessible and inaccessible points. Plot profiles.
3. Demonstrate the use of total station, find areas and plot contours using Total station.
4. Set curves using theodolite and total station.
5. Mark centerline of building for construction.

ADDITIONAL MATHEMATICS – I

Course Code: AM 31 **Credits: 0:0:0**

Contact Hours: 40L

Course Content

Unit I
Differential Calculus-I -08 Hrs

Successive differentiation, n^{th} derivatives of some standard functions, Leibnitz theorem, Polar curves. Angle between the radius vector and the tangent, angle between curves, length of the perpendicular from pole to the tangent, pedal equations. Taylor's and Maclaurin's expansions.

Unit II
Integral Calculus -08 Hrs

Introduction, Reduction formula, Reduction formula for $\int sin^n x\, dx$, Reduction formula for $\int cos^n x\, dx$, Reduction formula for $\int sin^n x cos^m x\ dx$, Evaluation of double and triple integrals.

Unit III
Vector Algebra-08 Hrs

Scalar and vectors. Vector addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple product-simple problems. Vector functions of a single variable. Derivative of a vector function, geometrical interpretation. Velocity and acceleration.

Unit IV
Vector Differentiation-08Hrs

Scalar and vector fields, gradient of a scalar field, directional derivative, divergence of a vector field, solenoidal vector, curl of a vector, irrotational vector, Laplace's operator. Vector identities connected with gradient, divergence and curl.

Unit V
First Order Differential Equations-08 Hrs

Solution of first order and first degree differential equations, variable separable methods, homogeneous equations, linear and Bernoulli's equations, exact differential equations.

Text Books:

1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. Erwin Kreyszig –Advanced Engineering Mathematics, Wiley publication, 10th edition, 2015.

References:

1. H.K. Dass – Higher Engineering Mathematics – S Chand Publications - 1998.
2. B.V. Ramana – Engineering Mathematics – Tata McGrawHill Publishing Co. Ltd. – New Delhi – 2008.

Course Outcomes (COs):

At the end of the course the student will be able to

1. Find the length of the perpendicular from pole to tangent and determine the series expansion of differentiable functions (PO-1, 2)
2. Evaluate multiple integrals (PO-1, 2)
3. Analyze and solve problems related to Vector Algebra. (PO-1, 2)
4. Apply vector differentiation to identify solenoidal and irrotational vectors. (PO-1, 2)
5. Solve the first order and first degree ordinary differential equations. (PO-1, 2)

ENGINEERING MATHEMATICS – IV

Course Code: CV 41 **Credits: 3:1:0**

Contact Hours: 42+14

Course Content

Unit I

Finite differences and interpolation: Forward and backward differences, Interpolation, Newton –Gregory forward and backward interpolation formulae, Lagrange's interpolation formula, Newton's divided difference interpolation formula (no proof).

Numerical differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule.

Unit II

Solution of PDE's using Finite difference method: Classification of second order PDE, Solution of one dimensional heat equation using implicit and explicit methods, one dimensional wave equation using explicit method & two dimensional Laplace and Poisson equations.

Unit III

Random Variables: Random Variables (Discrete and Continuous), Probability mass and density function, Cumulative density function, Mean, Variance, Moment generating function.

Probability Distributions: Binomial distribution, Poisson distribution

Unit IV

Probability Distributions: Normal distribution, Exponential distribution, Uniform distribution, Gamma distribution, Joint probability distributions (discrete and continuous).

Unit V

Sampling and Statistical Inference: Sampling distributions, Concepts of standard error and confidence interval, Central Limit Theorem, Type-1 and Type-2 errors, Level of significance, One tailed and two tailed tests, Z-test: for single mean, for single proportion, for difference between means, Student's t –test: for single mean, for difference between two means, F – test: for equality of two variances, Chi-square test: for goodness of fit, for independence of attributes.

Text Books:

1. Erwin Kreyszig - Advanced Engineering Mathematics-Wiley-India publishers-10th edition 2015.
2. B.S. Grewal - Higher Engineering Mathematics - Khanna Publishers – 44th edition-2017.

Reference Books:

1. B. S. Grewal – Numerical methods in engineering and science- Khanna Publishers-8th edition-2015.
2. Murray R. Spiegel, John Schiller & R. Alu Srinivasan - Probability & Statistics - Schaum's outlines-3rd edition - 2007.

Course Outcomes (COs):

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

1. Find functional values, derivatives, areas and volumes numerically from a given data. (PO-1,2 & PSO-1)
2. Solve Partial differential equations numerically. (PO-1,2 & PSO-1)
3. Analyze the given random data and their probability distributions. (PO-1,2 & PSO-1)
4. Apply the concept of probability distributions to solve engineering problems. (PO-1,2 & PSO-1)
5. Use sampling theory to make decisions about the hypothesis. (PO-1,2 & PSO-1)

STRUCTURAL ANALYSIS

Course Code: CV 42 **Credits: 3:1:0**

Contact Hours: 42+14

Course Content

Unit I

Introduction and Analysis of Plane Trusses: Structural forms, Conditions of Equilibrium. Static and Kinematic indeterminacies of structural systems. Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.

Unit II

Deflection of Beams: Basic concepts, Basic formulae. Deflection of statically determinate beams by Moment area and Conjugate beam methods.

Energy Principles and Energy Theorems: Principle of virtual displacements and virtual forces, Strain energy stored due to axial loading and bending. Strain energy stored by a beam subjected to a uniform bending moment. Deflection of determinate beams and trusses using total strain energy, Castigliano's theorems and its application to estimate the deflections of trusses.

Unit III

Arches and Cable Structures: Three hinged parabolic arches with supports at same and different levels, Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL, Length of cables for supports at same and at different levels.

Unit IV

Influence Lines and Rolling Loads: Concept of influence lines, ILD for reactions, SF and BM for determinate beams. ILD for determinate structures- BM, SF and axial forces. Maximum BM and SF in determinate beams using rolling loads concepts.

Unit V

Introduction to Indeterminate Structures: Propped cantilever and fixed beams using method of consistent. Three moment equations (three span beams.)

Text Books

1. P Reddy C.S., “Basic Structural Analysis”, Tata McGraw Hill, New Delhi.
2. KU Muthu, Azmi Ibrahim, “Basic Structural Analysis”, IK International Publishing House.

References

1. Pandit and Guptha, “Theory of Structures, Vol I and II”, Tata McGraw Hill, New Delhi.
2. Norris and Wilur, “Elementary Structural Analysis”, International Student Edition, McGraw Hill, New York.
3. Negi and Jangid, “Structural Analysis”, Tata McGraw Hill, New Delhi.
4. Ashok K Jain, “Elementary Structural Analysis”, Nemchand Publishers, Roorkee

Course Outcomes (COs):

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

1. Describe different forms of structures and evaluate their indeterminacy, and analyze determinate truss.
2. Analyze the deflection of simple beams by different methods.
3. Analyze arches and cables with supports at same and different levels.
4. Develop influence lines for long span structures and describe the behavior of structural components subjected to rolling loads.
5. Analyze the indeterminate structures.

HYDRAULIC ENGINEERING

Course Code: CV 43 **Credits: 3:1:0**

Contact Hours: 42+14

Course Content

Unit I

Hydraulic Machines: Force exerted by fluid jet on moving curved vane striking at its centre and one of the tips, Velocity triangles, Equation for work done and efficiency. Turbines - Introduction. Components and Layout of Hydroelectric power plant, Head and Efficiency of turbines, Classifications of turbines, Pelton wheel, Equation for work done and efficiency. Working proportions of Pelton wheel turbine. Reaction Turbines – Francis turbine, Kaplan turbine, Draft tube theory, Governing of turbines. Performance of Turbines - Unit quantities, Specific speed of a turbine, Performance characteristics curves. Pumps - Centrifugal pumps, Classification of centrifugal pumps, Work done by the impeller, Priming of pumps, Head of a pump, Efficiencies, Minimum starting speed, NPSH, Cavitation in centrifugal pumps, Multistage pump, Performance of centrifugal pumps. Introduction to submersible pump.

Unit II

Open Channel Flow: Introduction. Types of open channels. Geometrical properties of channel sections. Uniform flow in channels - Chezy's formula, Manning's formula. Most economical channel sections - Rectangular, triangular and Trapezoidal sections. Computation of uniform flow. Specific energy & Critical flow - Specific energy curve, Critical flow in rectangular channels. Problems on humps. G.V.F. - Dynamic equation, Classification of flow profiles. R.V.F. - Hydraulic jump in rectangular channels, Types of jumps, Applications of hydraulic jumps.

Unit III

Dimensional Analysis and Model Studies: Introduction. Units and dimensions. Dimensional Homogeneity. Methods of Dimensional Analysis - Raleigh's method and Buckingham's method. Model studies. Similitude - Geometric, Kinematic and Dynamic similarities. Force ratio & Dimensionless numbers. Similarity laws - Reynold's model law, Froude model law, Euler model law. Types of models - Undistorted models and distorted models. Introduction to Drag and Lift, Types of Drag, Evaluation of drag on a sphere and Lift on an airfoil using dimensional analysis.

Unit IV

Hydrology: Introduction. Hydrologic cycle, World water budget. Precipitation- Forms, Types, Measurement of precipitation, Hyetograph, Rain gauge network, Mean precipitation over an area, Estimation of missing rainfall data, Double mass curve technique, Return period, Plotting positions, I.D.F.curves, P.M.P. Catchment - definition, stream pattern, description of the basin.

Unit V

Abstractions from Precipitation: Introduction. Abstractions - Evaporation, Factors affecting evaporation, Measurement of evaporation using evaporation pans, Methods of reduction of reservoir evaporation, Transpiration, Evapotranspiration, Estimation of evapotranspiration. Infiltration - Infiltration capacity, Infiltration rate, Horton's infiltration curve, Infiltration indices. Groundwater - Introduction. Specific retention, Specific yield, Darcy's Law, Hydraulic conductivity, Transmissivity. Well Hydraulics - Steady-radial flow into a confined aquifer, Thiem's equation, Steady-radial flow into an unconfined aquifer. Well irrigation: Advantages and disadvantages. Tube wells - types, methods for drilling, yield, problems.

Text Books

1. P.N. Modi & S.M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House.
2. 2. C.S.P. Ojha, P.N. Chandramouli, and R. Berndtsson, "Fluid Mechanics and Machinery", Oxford University Press.
3. K. Subramanya, "Engineering Hydrology", Tata McGrawHill.

References

1. Streeter, Wylie and Bedford, "Fluid Mechanics", Tata McGraw-hill Edition 2010.
2. Subramanya. K, "Fluid Mechanics Through Problems", Tata McGraw-hill Publishing Company.
3. P. Jayarami Reddy, "Hydrology", Laxmi Publication.

Course Outcomes (COs):

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

1. Design and evaluate the performance of Hydraulic Machines.
2. Design open channels for various types of flow systems in open channels.
3. Apply similarity laws and study models to evaluate the behaviour of proto type.
4. Appraise water resources potential on earth and its data analysis in evaluating extreme hydrological events.
5. Estimate various abstractions from precipitation and evaluate groundwater potential.

TRANSPORTATION ENGINEERING-I

Course Code: CV 44 **Credits: 4:0:0**

Contact Hours: 56

Course Content

Unit I

Transportation Systems: Transportation Developments in India, highway alignment and engineering surveys, new and re-alignment projects, Introduction to urban transport planning and Intelligent Transport system.

Highway Economics: Highway user benefits - tangible and intangible - motor vehicle operation cost - annual highway costs, methods of economic analysis - highway financing, BOT, BOOT.

Unit II

Geometric Design: Introduction to highway geometric design, highway cross sectional elements. Sight distances, Horizontal alignment design, Vertical alignment design. Geometrical specification of Hill roads.

Traffic Engineering: Scope, traffic characteristics, volume studies, speed studies, O & D studies, PCU and Traffic Capacity, Level of service, Accident Studies.

Unit III

Pavement Materials: Significance and requirements of subgrade soil, soil classification, plate load test and CBR test on soil, properties and requirements of aggregates and bitumen, tar and emulsions. Use of new and marginal materials in road construction.

Bituminous Mix Design: Requirements, Methods of mix design, Marshall Method.

Unit IV

Pavement Design: Requirements of highway pavements - Types and design factors, ESWL, design of flexible pavements by IRC method, stresses in rigid pavements - wheel load stresses, temperature and frictional stresses, combination of stresses, design of rigid pavements by IRC method. Failures and causes in flexible and rigid pavements and remedial measures.

Unit V

Highway Drainage: Significance and requirements of highway drainage design of surface and subsurface system, Drainage work in hill roads.

Pavement evaluation: Structural Evaluation of pavements, Functional evaluation of pavements, Overlay Design.

Text Books

1. Khanna S.K. and Justo C.E.G, “Highway Engineering”, Nemchand and Bros, Roorkee.
2. Kadiyali L.R, “Highway Engineering”, Khanna Publishers, New Delhi.

References

1. Subramanyam. K.P, “Transportation Engineering”, Scitech Publications, Chennai.
2. Khanna SK and Justo CEG, “Highway Material Testing Laboratory Manual”, Nemchand and Bros.

Course Outcomes (COs):

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

1. Describe transportation systems and carry out economic feasibility analysis for road projects.
2. Define highway geometrics and traffic engineering.
3. Characterize materials for pavement construction and design bituminous mixes.
4. Design the flexible and rigid pavements.
5. Design the drainage systems and evaluate pavement systems.

CONSTRUCTION MATERIALS AND CONCRETE TECHNOLOGY

Course Code: CV 45 **Credits: 4:0:0**

Contact Hours: 56

Course Content

Unit I

Construction Materials: Engineering Stones, Bricks, Timber, Lime. Cement- Composition of Ordinary Portland Cement (OPC), Types of cement, sand and their uses. Pozzalonic materials such as flyash, meta kaolin, silica fume, rice husk ash and blast furnace slag. Lime and Cement mortar. Desirable properties o f Reinforcing steel, structural steel and aluminum. Masonry - Stone and brick. Construction of brick masonry using English and Flemish bond.

Unit II

Structural Components: Foundations- Classifications & different types, Bearing capacity of soil. Flooring requirements for floor finish and its types. Doors paneled and flush doors. Different types of Windows, Ventilators. Stairs - requirements of stairs. Dog-legged and open well staircase. Lintel, Chajja, Balcony. Plastering and Pointing, Paints- Purpose, types, ingredients and applications of paints to new and old plastered surfaces, Form Works and Scaffoldings.

Unit III

Concrete Ingredients and Microstructure: Cement- hydration of cement. Bogue's compound and transition zone in cement paste. Tests on cement-field test and laboratory tests (detailed procedures covered in laboratory). Quality of mixing water. Aggregates – Physical properties of Coarse and Fine aggregate. Sieve analysis, Fineness, grading of aggregates (detailed procedures to be covered in laboratory). Structure of aggregate phase, structure of hydrated cement paste, structure- property relationship in hydrated cement paste. Manufactured sand its significance and differences. Blended cement and its importance.

Unit IV

Fresh Concrete &Mix Design: Workability - definition, factors affecting workability, measurement of workability by slump, compaction factor, vee-bee and flow tests. Segregation and bleeding. Process of manufacture of concrete-batching, mixing, transporting, placing, compaction and curing of concrete. Admixtures and its classification and its uses. Concept of mix design, variables in proportioning, exposure conditions, procedure of mix design as per IS10262-2019 and numerical examples of mix design. Introduction and fresh properties of Self Compacting Concrete.

Unit V

Hardened Concrete: Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, effect of aggregate properties, accelerated curing, Aggregate-cement bond strength. Shrinkage– plastic shrinkage and drying shrinkage, factors affecting shrinkage. Creep–measurement of creep, factors affecting creep, effect of creep. Durability–definition and significance. Permeability, sulphate attack, chloride attack and carbonation. Factors contributing to cracks in concrete–plastic shrinkage, settlement cracks and construction joints. Tests on hardened concrete-compressive strength, split tensile strength, flexural strength. (Detailed test procedures to be covered in laboratory).

Text Books

1. Sushil Kumar, "Building Construction", Standard Publishers Distributors, New Delhi.
2. S. C. Rangawala, "Building Construction" & "Engineering materials" Book Stall, Anand.
3. M S Shetty, "Concrete Technology", Chand S and Co.
4. Gambhir B L, "Concrete Technology", Tata McGraw Hill, New Delhi.

References

1. Neville, A M, "Properties of Concrete", ELBS Publications.
2. IS: 10262 – "Recommended guidelines for Concrete Mix design", – BIS Publications Mehta PK, Properties of Concrete, ICI, Chennai.
3. Mohan Raj and Jai Singh, "Advanced Building Materials and Construction", CBRI Publications, Roorkee.
4. B.C. PUNMIA, "Building Construction", Lakshmi Publications, New Delhi.

Course Outcomes (COs):

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

1. Describe the basic Engineering Properties of the construction materials.
2. Demonstrate use of binders and construction materials.
3. Describe the ingredients of concrete and its microstructure.
4. Demonstrate use of fresh properties of concrete along with mix design.
5. Evaluate hardened and durability properties of concrete.

ENVIRONMENTAL ENGINEERING-II

Course Code: CV 46 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction to wastewater: Terms used in wastewater engineering, various sources and types of wastewater. Domestic wastewater- concept of grey, black and storm water.
Management of wastewater within the building: Different types of traps used in the building plumbing based on shape and locations. Sanitary fixtures: Water closets- conventional and water efficient (low flush, dual flush, vacuum and water less), urinals – conventional and water efficient/ waterless. Importance of grey water separation and reuse. Different types of plumbing system. Single stack, one pipe and two pipe systems. Drainage plan for a residential building. Management of Rainwater in buildings: Discharge into storm water drains, rainwater filtration for reuse and rainwater ground recharge plans.

Unit II

Collection of wastewater: Types of sewerage systems. Quantity of wastewater: Dry and wet weather flow. Factors affecting Dry weather flow. Sewage flow variations. Estimation of quantity of sewage and storm water using rational formula. Time of concentration and return period. Sewers- limiting velocities, effects of variation of flow. Design of sewer section using Manning's equation (Circular section with half and full flow conditions only). Types of sewer sections and suitability. Sewer materials, construction of sewers, sewer maintenance and cleaning.

Unit III

Sewer Appurtenances: Street inlets, catch basins, infiltration pits in storm water drains. Manholes along with drop manholes. Sampling of wastewater- grab and composite sampling. Wastewater characteristics: Physical characteristics including colour, solids and pH. Chemical characteristics including chlorides, nitrogen content and heavy metals. Aerobic and anaerobic activity. Biological characteristics of wastewater: Concept of BOD and COD. BOD kinetics and Problems. General standards for discharge of environmental pollutants.

Unit IV

Treatment of wastewater: Conventional flow diagram of wastewater treatment. Preliminary and primary treatment of wastewater: Screenings, grit removal, removal of oil and grease. Sedimentation- details and design of circular sedimentation tanks.

Secondary treatment of wastewater: Activated sludge: concepts, modifications and design of aeration tank. Trickling filters: Concepts, types and design of trickling filters. Sludge digestion: Anaerobic sludge digester, process details and sludge drying beds.

Unit V

Miscellaneous treatment methods (Working principles): oxidation pond, aerated lagoon, rotating biological contractor, moving bed biological reactor (MBBR), Up flow Anaerobic Sludge Blanket – UASB. Onsite wastewater treatment: Septic tank-leach pit and dispersion trench. Grey water treatment methods: Greywater separation, possible reuse of greywater, onsite treatment of grey water: low cost filters; other treatment methods – Carbon adsorption, phosphorous removal, nitrification and de-nitrification, ammonia stripping, land treatment.

Text Books

1. Garg S K, "Sewage disposal and air pollution engineering", Khanna Publications, 2019, ISBN-10: 9788174092304.
2. Punmia B C. and Ashok Jain, Environmental Engineering II, Laxmi Publications, 2016, ISBN-10: 8131805964.

References

1. Manual on sewerage and sewage treatment systems, Part A B and C Central public health and environmental engineering organization (CPHEEO), Ministry of urban development.
2. Metcalf and Eddy, "Wastewater Engineering- Treatment and Reuse" Tata McGraw Hill India, 2002, ISBN-10: 007124140X.

Course Outcomes (COs):

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

1. Identify the sources of wastewater from building and design plumbing system for a building.
2. Compute the quantity of wastewater and design, construct and maintain sewers.
3. Illustrate sewer appurtenances and describe the characteristics of wastewater.
4. Plan and design wastewater treatment facilities.
5. Describe alternative and onsite methods of wastewater treatment.

ENGINEERING GEOLOGY LABORATORY

Course Code: CVL 47 **Credits: 0:0:1**

Contact Hours: 14

List of Experiments:

1. Identification of Rock forming minerals (Silicate minerals)
2. Identification of Rock forming minerals (Non-silicate minerals)
3. Identification of Ore forming/Industrial based minerals (Non-silicate minerals)
4. Recognition and descriptive study of Igneous rocks.
5. Recognition and descriptive study of sedimentary rocks.
6. Recognition and descriptive study of Metamorphic rocks.
7. Study of Geological maps and their interpretation of Sections.
8. To find out the Dip and strike of the geological formation (Surface method problems)
9. To find out the thickness of Beds of the geological formation (True thickness & vertical thickness problems)
10. To find out the Borehole problems of three and four level (Sub surface dip and strike)
11. Visual interpretation of satellite imagery, Digitization of thematic layer, lay-outing and map preparation.

Text Book:

1. Parbin Singh "Text book of Engineering and General Geology", Katson publication house, Ludhiana, 2009.
2. Mukerjee,P.K "Text book of Geology", World press Pvt. Ltd. Kolkatta
3. Maruthesha Reddy, M.T. "Applied Engineering Geology", Subhas stores, Bangalore, 2013.

Reference Lab Manual:

1. Gurrappa, "Standard geological and topographical maps"
2. SatyanarayanaSwamy, Engineering Geology lab manual"
3. Maruthesha Reddy, M.T."Lab manual of engineering Geology observation book", Subhas stores, Bangalore, 2017.

Course Outcomes (COs):

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

1. Determine rock forming minerals and ore/industry forming minerals.
2. Scrutinize the different types of rocks and their properties.
3. Demonstrate Construction of surface and subsurface geological maps.
4. Estimate the thickness of ground strata from drill-hole logs.
5. Delineate thematic layers trough geo-informatics techniques.

FLUID MECHANICS LABORATORY

Course Code: CVL 48 **Credits: 0:0:1**

Contact Hours: 14

List of Experiments:

1. Verification of Bernoulli's theorem
2. Reynold's experiment
3. Losses in pipes
4. Calibration of Venturimeter and Orificemeter
5. Calibration of V-Notch
6. Calibration of Rectangular Notch
7. Calibration of Cipolletti Notch
8. Calibration of Broad Crested Weir
9. Calibration of Ogee Weir
10. Orifice/Mouth piece
11. Impact of Jet on Vanes
12. Centrifugal Pump
13. Pelton Wheel Turbine

Text Book:

1. P. N. Modi & S. M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House.
2. C.S.P. Ojha, P.N. Chandramouli, and R. Berndtsson, "Fluid Mechanics and Machinery", Oxford University Press.

Reference Lab Manual:

1. Streeter, Wylie and Bedford, "Fluid Mechanics", Tata McGraw-hill Edition 2010.
2. Subramanya. K, "Fluid Mechanics Through Problems", Tata McGraw-hill Publishing Company.

Course Outcomes (COs):

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

1. Verify and visualize basic principles of fluid flow.
2. Demonstrate experiments on flow measuring devices in pipe and calibrate them.
3. Demonstrate experiments on flow measuring devices in open channel and calibrate them.
4. Chart the characteristics of hydraulic machinery for analysing their performance.
5. Estimate the performance of hydraulic machinery and its suitability.

ADDITIONAL MATHEMATICS – II

Course Code: AM 41 **Credits: 0:0:0**

Contact Hours: 40L

Course Content

Unit I

Differential calculus - 08 Hrs

Partial differentiation, Euler's theorem, total differential coefficient, differentiation of composite and implicit functions, Jacobian and Properties. Taylor's theorem for function of two variables, maxima and minima for functions of two variables.

Unit II

Vector integration – 08 Hrs

Line integrals, surface integrals and volume integrals. Green's theorem, Stokes' and Gauss divergence theorem (without proof) and problems, orthogonal curvilinear coordinates.

Unit III

Laplace transforms - 08 Hrs

Definitions, Laplace transforms of elementary functions, derivatives and integrals, periodic function, unit step function, inverse transforms, applications of Laplace transforms to solve differential equations.

Unit IV

Higher Order Differential Equations - 08 Hrs

Higher order linear differential equations, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations.

Unit V

Probability - 08Hrs

Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability-illustrative examples. Bayes theorem –examples.

Text Books:

1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 44thedition, 2017.
2. Erwin Kreyszig –Advanced Engineering Mathematics, Wiley publication, 10th edition, 2015.

References:

1. H.K. Dass – Higher Engineering Mathematics – S Chand Publications - 1998.
2. B.V. Ramana – Engineering Mathematics – Tata McGraw Hill Publishing Co. Ltd. – New Delhi – 2008.

Course Outcomes (COs):

At the end of the course the student will be able to

1. Find Jacobian, extreme values and power series expansion of a function. (PO-1, 2)
2. Exhibit the interdependence of line, surface and volume integrals using integral theorems. (PO-1, 2)
3. Use the concept of Laplace transforms to solve initial and boundary value problems (PO-1, 2)
4. Solve Linear differential equations with constant and variable coefficients (PO-1, 2)
5. Demonstrate the understanding of axioms and rules of probability to solve problems. (PO-1, 2)