BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2021 – 22

Choice Based Credit System (CBCS)

UG PROGRAM: B.E., CIVIL ENGINEERING | **Semester: IV**

Sl. No.	Course category	Course Code	Course Title	Teaching Dept.	Teaching Hours/Week			Credits	Examination			
					L	T	P		Duration	CIE Marks	SEE Marks	Total Marks
1	BS	21MTA41	Numerical Methods, Complex Variable and Sampling Theory	MAT	3	1	1	4	3	50	50	100
2	HSS	21CIP42	Constitution of India, Professional Ethics	HS	1	0	0	1	2	50	50	100
3	UHV	21UHV43	Universal Human Values- II	CV	1	0	0	1	1	50	50	100
4	HSS	21HSS44	Environmental Studies	HS	2	0	0	2	2	50	50	100
5	PC	21CV45	Structural Analysis	CV	2	2	0	3	3	50	50	100
6	PC	21CV46	Water Supply and Sanitary Engineering	CV	2	2	0	3	3	50	50	100
7	PC	21CV47	Engineering Surveying	CV	2	2	0	3	3	50	50	100
8	PC	21CVL48A	Survey Practice Laboratory	CV	0	0	2	1	3	50	50	100
9	PC	21CVL48B	Computer Aided Building Planning and Drawing	CV	0	0	2	1	3	50	50	100
10	PC	21CVL48C	Engineering Geology Laboratory	CV	0	0	2	1	3	50	50	100
TOTAL					**13**	**7**	**11**	**20**	**-**	**500**	**500**	**1000**
					31							

Note: BS: Basic Science; PC: Professional Course; HSS: Humanity and Social Science; AEC: Ability Enhancement Courses, L: Laboratory Course; INT: Internship; UHV: Universal Human Values;

Course Prescribed to Lateral Entry Diploma holders admitted to III Semester B.E.												
1	NCMC	21DIP41A	Diploma Mathematics- II	MAT	3	0	0	0	3	100	--	100

- Lateral Entry Students have to undergo Internship- I during the intervening vacation of III and IV Semesters.
- The Assessment Pattern for 1/2/3 credit courses shall be done as per VTU guidelines.
- Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA but completion of the courses shall be mandatory for the award of the degree

- Successful completion of the course Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non completion of the courses diploma mathematics shall be indicated as unsatisfactory.

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Numerical Methods, Complex Variable and Sampling Theory (3:1:1) 4

(Common to ECE, ETE, EEE, MECH & CIVIL Branches)

(Effective from the academic year 2020-21)

Course Code	21MTA41	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	50
Total Number of Contact Hours	50	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Apply the concept of Numerical Techniques, probability distribution and stochastic processes to analyze problems arising in Science and Engineering field.
2. Analyze engineering problems by applying the concept of Complex Analysis, Curve fitting and Statistical Methods.

Module – 1

Introduction:

Understanding the importance of the study of Complex Analysis, Transformations, Numerical techniques, Statistics, Probability and Sampling Distributions and their applications in the field of Science, Engineering, Business & Research.

Numerical Methods:

Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's method. 4^{th} order Runge -Kutta method, Milne's predictor and corrector methods, Numerical solution of ordinary differential equations of second order - 4^{th} order Runge - Kutta method, Numerical solution of algebraic and transcendental equations by Regula Falsi method and Newton Raphson method.

Self-Learning Component: Picard's method

Lab Session 1:

Solution of differential equation using Euler Method, 4th order Runge- Kutta method.
Determination of roots of a polynomial by Newton Raphson method, Regula Falsi method.

(10 Hours)

Module – 2

Complex Variables:

Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions - Cauchy-Riemann equations in Cartesian and Polar forms, Construction of analytic functions by Milne's method. Complex line integrals - Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems.

Transformation:

Bilinear transformation: Definition, problems.

Self-Learning Component: problems on conformal transformations, Proof of Cauchy integral formula, Cauchy integral formula for derivatives.

Lab Session 2:

Conformal mapping using matlab for $W = e^z, W = z^2,\ W = z + \frac{1}{z}\ (z \neq 0)$, complex valued functions.

Compute residues and poles for complex functions.

(10 Hours)

Module – 3

Curve fitting:

Fitting linear and geometric curves by the method of least squares.

Statistics:

Review of measures of central tendency and dispersion. Regression analysis: Correlation-Karl Pearson's coefficient of correlation - problems. Lines of regression (without proof) –Problems.

Calculus of variation:

Variation of a function and a functional, Extremal of a functional, Euler's equation, Standard variational problems.

Self-Learning Component: Fitting quadratic curves by the method of least squares.

Lab Session 3:

Determination of polynomial using method of Least Square Curve Fitting.

Relation between variables: correlation, Regression.

(10 Hours)

Module – 4

Probability Distributions:

Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and Normal distributions, problems.

Self-Learning Component: Joint Probability distribution for two continuous random variables.

Lab Session 4:

Compute Pdf/pmf for given data.

Compute and Plot the probability density function for Normal Distribution, Binomial Distribution, Exponential Distribution, Poisson Distribution.

(10 Hours)

Module – 5

Sampling Theory:

Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution & Chi-square distribution as a test of goodness of fit.

Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, problems.

Self-Learning Component: Test of hypothesis for difference of means and difference of Proportions.

Lab Session 5:

Testing of hypothesis using Chi-square distribution.

Testing of hypothesis using t – distribution.

Recap/Summary of the Course.

(10 Hours)

Course Outcomes:

The students will be able to:

CO1: Solve order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.

CO2: Explain the concepts of analytic functions, residues, poles of complex potentials and describe conformal and Bilinear transformation arising in field theory and signal processing.

CO3: Make use of the concepts of method of least squares, correlation and regression analysis to fit a suitable mathematical model for the statistical data and determine the extremal of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

CO4: Develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, information theory and design engineering.

CO5: Demonstrate testing of hypothesis of sampling distributions and illustrate examples of Markov chains related to discrete parameter stochastic process.

Question paper pattern:

- **SEE** will be conducted for 100 marks.
- **Part A:** First question with 20 MCQs carrying 1 mark each.
- **Part B:** Each full question is for 16 marks. (Answer five full questions out of 10 questions with intra modular choice). In every question, there will be a maximum of three sub-questions.
- **CIE** will be announced prior to the commencement of the course.
- 25 marks for test. Average of three tests will be taken.
- 25 marks for Alternate Assessment Method.

Textbooks:

1. Grewal B. S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. Kreyszig E., “Advanced Engineering Mathematics”,10th Edition, John Wiley & Sons, 2015
3. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw-Hill Education, 2010.

References:

1. P. Bali, Manish Goyal, “A Text Book of Engineering Mathematics”, Laxmi Publishers, 2014.
2. Sastry.S.S, “Introductory Methods of Numerical Analysis”, 4th Edition, Prentice Hall of India, 2010.
3. Dass H. K, Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Ltd, 2014.
4. Kandasamy P, K. Thilagavathy, K. Gunavathy. “Engineering Mathematics”, S. Chand, Vol. III, 2001.

Choice Based Credit System (CBCS)
SEMESTER – III/IV

Constitution of India and Professional Ethics (1:0:0) 1
(Common to all Branches)
(Effective from the academic year 2021-2022)

Course Code	21CIP32/42	CIE Marks	50
Teaching Hours/Week (L:T:P)	1-0-0	SEE Marks	50
Total Number of Lecture Hours	13	Exam Hours	2

Course objectives:

This course will enable students to

1. Familiarise with the Indian Constitution and have legal knowledge enabling them to take competitive exams and understand complex political issues.
2. Understand engineering ethics and responsibility and raise awareness and consciousness of the issues related to the profession, liability, risk and safety at work place.

Module – 1

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation.

Introduction and Basic information about the Indian Constitution:

Introduction, Definition and significance of the Indian Constitution, Historical Background of the Indian Constitution. Framing of the Indian constitution: Role of the Constituent Assembly, Preamble and Salient features of the Constitution of India. **2 Hours**

Module – 2

Fundamental Rights, Directive Principles of State Policy and Fundamental Duties:

Fundamental Rights and its limitations, Directive Principles of State Policy: Importance and its relevance. Fundamental Duties and their significance. Case Studies **3 Hours**

Module – 3

Union Administration:

The Union Executive-The President and The Vice President, The Prime Minister and The Council of Ministers, The Union Legislature -Lok Sabha & Rajya Sabha, The Union Judiciary- The Supreme Court of India and its jurisdiction. **3 Hours**

Module – 4

State Administration, Elections, Constitutional Amendments, Emergency Provisions and Special Constitutional Provisions:

The State Executive-The Governors, The Chief Ministers and The Council of Ministers, The State Legislature- Legislative Assembly and Legislative Council, The State Judiciary- The State High Courts and its jurisdiction.

Elections-Electoral Process in India, Election Commission of India: Powers & Functions, Constitutional Amendments- methods and Important Constitutional Amendments ie 42^{nd}, 44^{th}, 61^{st},74^{th}, 76^{th}, 77^{th}, 86^{th} ,91^{st}, 100, 101^{st}, 118^{th} , Emergency Provisions-types and its effect,

Special Constitutional Provisions for Schedule Castes, Schedule Tribes & Other Backward Classes Women & Children. **3 Hours**

Module – 5

Professional Ethics:

Definition of Ethics, Scope and Aim of Professional and Engineering Ethics, Code of ethics as defined in the Institution of Engineers (India), Responsibilities of Engineers and impediments to responsibilities, Honesty, Integrity and Reliability of Engineers, Risk, Safety and Liability in Engineering, Case Studies. **2 Hours**

Course outcomes: The students will be able to:

CO1. Understand and have constitutional knowledge and legal literacy

CO2. Understand Engineering and Professional ethics and responsibilities of Engineers.

Question paper pattern:

- **SEE** will be conducted for 100 marks. The same will be reduced to 50 Marks.
- **There shall be 100** MCQs, each carrying 1 mark.
- **CIE** will be announced prior to the commencement of the course.
- 50 marks for test. Average of three tests will be taken and reduced to 25.
- 25 marks for Alternate Assessment Method.

Textbooks

1. Durga Das Basu, Introduction to the Constitution of India, Lexis Nexis, 20th Edn, 2011.

2. Shubham Singles, Charles E. Haries and Et al, Constitution of India and Professional Ethics, Cengage Learning India Private Limited, Latest Edition, 2018.

References

1. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Engineering Ethics, Prentice –Hall of India Pvt. Ltd. New Delhi, 2004.

2. M.V.Pylee, An Introduction to Constitution of India, Vikas Publishing,2002.

Choice Based Credit System (CBCS)
SEMESTER – IV

Universal Human Values- II (1:0:0) 1
(Effective from the academic year 2021-2022)

Course Code	21UHV43	CIE Marks	50
Teaching Hours/Week (L: T:P)	1-0-0	SEE Marks	50
Total Number of Lecture Hours	13	Exam Hours	1

Course objectives:

This introductory course is intended to

1. Develop a holistic perspective based on self-exploration about family, society and nature/existence.
2. Understand harmony in the family, society and nature/existence
3. Strengthening of self-reflection.
4. Develop commitment and courage to act.

Module – 1

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation.

Harmony in the Family: Understanding values in human relationships; Family as basic unit; Harmony in family, Recognizing feelings in relationships-trust, respect, affection, care, guidance, reverence, glory, gratitude and love.

Case study and Group Discussion **3 Hours**

Module – 2

Harmony in Society: Extending relationship from family to society; Comprehensive human goal, Five dimensions of human endeavor; Harmony from family order to World family order**.**

Case study and Group Discussion **2 Hours**

Module – 3

Harmony in the Nature: Understanding the harmony in the Nature; Interconnectedness, self-regulation and mutual fulfillment; four orders of nature; Recyclability, Natural characteristics.

Case study and Group Discussion **3 Hours**

Module – 4

Harmony in Existence: Understanding existence as co-existence; Space; Co-existence of units in space, various attributes of units and space, Role of a human being in existence.

Case study and Group Discussion **2 Hours**

Module – 5

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics, Holistic Technologies.

Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Case study and Group Discussion **3 Hours**

Course outcomes: The students will be able to:

1. Understand the role of a human being in ensuring harmony in family, society and nature, significance of value inputs in a classroom and start applying them in their life and profession

2. Distinguish between values and skills, ethical and unethical practices, happiness and accumulation of physical facilities, Intention and Competence of an individual etc and start working out the strategy to actualize a harmonious environment wherever they work

Question paper pattern:

- **SEE** will be conducted for 100 marks. The same will be reduced to 50 Marks.
- **There shall be 100** MCQs, each carrying 1 mark.
- **CIE** will be announced prior to the commencement of the course.
- 50 marks for test. Average of three tests will be taken and reduced to 25.
- 25 marks for Alternate Assessment Method.

Textbooks

1. The Textbook *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-47-1

2. The Teacher's Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, NewDelhi, 2019. ISBN 978-93-87034-53-2

References

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Small Is Beautiful: A Study of Economics as if People Mattered, E. F. Schumacher, 1973, Blond & Briggs, UK
4. Vivekananda - Romain Rolland (English)

Relevant websites, documentaries

1. Value Education websites, http://uhv.ac.in,
2. Story of Stuff, *http://www.storyofstuff.com*

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Environmental Studies (2:0:0) 2

(Common to All Branches)

(Effective from the academic year 2021-22)

Course Code	21HSS44	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:0	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Recognize the ecological basis for regional and global Environmental issues, and lead by example as an environmental steward.
2. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
3. Analyze the trans-national character of environmental problems and ways of addressing them, including interactions across local to global scales.
4. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as environmentalists.

Module – 1

Introduction: Relevance of the Subject to Historical and real-time Global, Economic and Societal Scenario. Internship and Job Opportunities in the current scenario.

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats to Biodiversity.

(5 Hours)

***Field work:** Visit to a local area to document environmental assets: river / forest / grassland / hill

Module – 2

Environmental Pollution & Abatement (with Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.

(5 Hours)

***Field work:** Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural, so as to observe and document environmental pollution and recommend remedial measures.

Module – 3

Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

(5 Hours)

***Field work:** Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural, so as to observe and document environmental impacts and recommend remedial measures.

Module – 4

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Fluoride problem in drinking water; Cloud Seeding, and Carbon Trading.

(5 Hours)

***Field work:** Visit to a Green Building, followed by understanding of process and its brief documentation.

Module – 5

Latest Developments in Environmental Pollution Mitigation (Concept and Applications): G.I.S. and Remote Sensing, Environment Impact Assessment (E.I.A.), Environmental Management Systems (E.M.S.), ISO14001.
Case Studies: Environmental Stewardship, Environmental NGOs.

***Field work:** Visit to an Environmental Engineering Laboratory / Water Treatment Plant/Wastewater treatment Plant, followed by understanding of process and its brief documentation

Summary of the Course

(6 Hours)

(*Note: Any 1 among the 5 Field works is mandatory from the Exercises discussed in across the 5 modules, and Students have to submit a report)

Course outcomes:

The students will be able to:

CO1: Appraise the significance of ecological systems under the ambit of environment.

CO2: Analyze for the consequences owing from anthropogenic interactions on the environmental processes.

CO3: Recommend solutions in the Anthropocene Epoch, with an in-depth understanding of the inter-disciplinary facets of environmental issues.

CO4: Elucidate the trans-national character of environmental problems and ways of addressing them.

CO5: Appraise latest developments, concerns and ethical challenges associated with Environmental Protection.

Question paper pattern:

- **SEE** will be conducted for 50 marks, and will comprise of 50 MCQs. The duration of exam is 2 hours.
- **CIE** will be conducted for 40 marks. It will be for 1-hour duration; it shall consist of 40 MCQs, each carrying 1 mark.
- **CIE** will be announced prior to the commencement of the course.
- Two assignments ought to be submitted each of 10 Marks
- One alternate assessment tools (AATs) from the list shall be planned to attain the COs and POs for 20 Marks (duration 01 hours)
- The average of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Text Books

1. Rajesh Gopinath and N. Balasubramanya, "Environmental science and Engineering", 1st Edition, City of Publisher, Cengage Learning India Private Limited, 2018.
2. J. S. Singh, S. P. Singh and S. R. Gupta, "Ecology, Environmental Science and Conservation", India, S. Chand Publishing, 2017.

References

1. M. Gadgil and R. Guha, "This Fissured Land: An Ecological History of India", Univ. of California Press, 1993.
2. E. P. Odum and H. T. Odum, "Fundamentals of Ecology", Philadelphia: Saunders Publisher, 1971.
3. M. L. Mckinney, "Environmental Science systems & Solutions", Web enhanced Edition, City of Publisher, R. M. Publisher, 1996.

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - IV

Structural Analysis (2:1:0) 3

(Effective from the Academic Year 2020 - 2021)

Course Code	21CV45	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	3

Course objectives:

This course will enable students to:

1. Impart knowledge on different methods of analysis
2. Apply various methods to find the deflection of beams and trusses
3. Analyze the beam, frames, arches and cables subjected to various loads
4. Understand the real times problems and provide the solution to them
5. Recognize the application and advancements of analysis of structures

Module – 1

Introduction: Structural forms, conditions of equilibrium, compatibility conditions, degree of freedom, Static and Kinematic indeterminacies of structural systems. Introduction to force and displacement methods of analysis.

Deflection of beams: Differential Equation for elastic line of a beam – Double Integration Method – Macaulay's Method – Area Moment Method-Determination of slope and deflection for cantilever, simply supported beams subjected point load, uniformly distributed load and varying load. Application to simple cases including overhanging.

(8 Hours)

Module – 2

Energy Principles: Castigliano's theorems - deflection of simple frames and trusses; Dummy unit load method

Moment Distribution Method: Introduction- Analysis of continuous beams with and without settlement of supports - analysis of rigid jointed frame including side sway. SFD, BMD and elastic curve (Kinematic indeterminacy restricted to 3)

(8 Hours)

Module – 3

Matrix Methods of Structural Analysis: Introduction- stiffness and flexibility matrix methods; Analysis of continuous beam & plane frame using stiffness matrix method (Kinematic indeterminacy restricted to 3)

(8 Hours)

Module – 4

Arches & Cable Structures: Types of arches; Analysis of three hinged arches - Parabolic and circular arches – Settlement and temperature effects; Analysis of cables under point loads and UDL; Length of cables with supports at the same and different levels; cables with three hinged stiffening girders

(8 Hours)

Module – 5

Moving Loads and Influence Lines: Introduction on moving loads, Definition of influence line for SF, Influence line for BM-load position for maximum SF at a section-Load position for maximum BM at a section- point loads, UDL longer than the span, UDL shorter than the span- two-point loads with fixed distance between them and several point loads

(8 Hours)

Course outcomes: The students will be able to:

CO1: Explain the concept of method of analysis & find the deflection by various methods.

CO2: Analyze the indeterminate structures by moment distribution and stiffness method

CO3: Analyze the arches, cables and structure subjected to moving loads

CO4: Identify and analyze the real times problems and arriving substantial conclusions

CO5: Recognize the applications and advancements of analysis of structures.

Question paper pattern:

- **SEE** will be conducted for 100 marks.
- **Part A:** First question with 20 MCQs carrying 1 mark each.
- **Part B:** Each full question is for 16 marks. (Answer five full questions out of 10 questions with intra modular choice). In every question, there will be a maximum of three sub-questions.
- **CIE** will be announced prior to the commencement of the course.
- 25 marks for test. Average of three tests will be taken.
- 25 marks for Alternate Assessment Method.

Text Books

1. Devdas Menon, "Structural Analysis", Narosa Book Distributors Pvt Ltd. 2010.
2. Bhavikatti S.S, "Structural AnalysisVol I&II", Vikas publishing house Pvt. Ltd, New Delhi, 2010.
3. Gupta S.P and.Pandit G.S, "Theory of Structures Vol I&II", Tata Mc.Graw Hill Education, 2017.
4. Vaidyanathan R and Perumal P, "Structural Analysis Vol I&II", Laxmi Publications, 2008.

References

1. Negi L.S and jangid R.S, "Structural Analysis", Tata Mc.Graw Hill Education, 2004.
2. Hibbeler R.C, "Structural Analysis" , Pearson, 2008.
3. Wang C.K, "Intermediate Structural Analysis", Tata Mc.Graw Hill Education, 2010.

Choice Based Credit System (CBCS)
SEMESTER – IV

Water Supply and Sanitary Engineering (3:0:0) 3
(Effective from the academic year 2021-22)

Course Code	21CV46	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Compare upon suitability and sources of water, and mode of distribution system for a township.
2. Identify the various Physical, Chemical and Biological treatment units in treating Water and Wastewater for the desired end use.
3. Distinguish the latest technologies in treatment through study of advanced research as case studies
4. Evaluate wastewater quality and the environmental significance upon its disposal to natural systems due to its various parameters.
5. Perform exercises in a group to address issues relevant to water and wastewater for any neighbourhood, with inferential analysis and suitable documentation of the same.

Module – 1

Introduction to the course: Relevance in the global scenario, Economics of planning, designing & executing water supply and sanitary engineering systems, Global Opportunities in the areas of Water conservation/ Source remediation and Water management & Reuse / Recycling of waste water. Internship opportunities in the areas of water management and wastewater treatment technologies.

Demands for Water: Need for protected water supply, Types of water demands, Per capita consumption –factors affecting per capita demand, population forecasting, different methods with merits & demerits, variations in demand of water.

Sources, Collection & Conveyance of Water: Surface and subsurface sources – suitability with regard to quality and quantity. Intake structures –different types of intakes; factor of selection and location of intakes. Pumps - Necessity, types.

Quality of Water: Water quality parameters - Physical, chemical and Microbiological. Sampling of water for examination. Water quality analysis using analytical and instrumental techniques. Drinking water standards as per BIS & WHO guidelines.

Design based Problems (DP)/Open Ended Problem: Analysis of water quality at source and consumer, along with Ground water level measurement; at different places, for Compliance check with drinking water quality standards.

Self-Learning Component: Literature Study of water quality and its issues in various places in Karnataka, and links established between water quality and health through these studies.

(9 Hours)

Module – 2

Water treatment Methodologies: Treatment flow-chart. Aeration - Principles, types of Aerators.

Sedimentation: Theory, Settling Tanks, Types, Design. Coagulant Aided Sedimentation, Jar Test, Chemical Feeding, Flash Mixing, and Clariflocculator.

Filtration: Mechanism – theory of filtration, rapid sand and pressure filters including construction, operation, cleaning and their design, backwashing of filters. Operational problems in filters.

Disinfection: Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, Latest technologies in disinfection.

Softening: Definition, methods of removal of hardness by lime soda process and zeolite process RO & Membrane technique.

De-fluoridation: Need of de-fluoridation**,** Methods of de-fluoridation.

Distribution Systems: System of supply, service reservoirs, methods of layout of distribution systems.

Self-Learning Component: Modern Software tools to design pipe networks.

(7 Hours)

Module – 3

Sanitation: Need for sanitation, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm flow, time of concentration flow,

Sewer appurtenances: material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers. Sewer appurtenances, Basic Principles of House Drainage, Typical Layout Plan Showing House Drainage Connections**.**

Design of sewers: hydraulic formula for velocity, effects of variation on velocity, regime velocity, design of hydraulic elements for circular sewers for full flow and partial flow conditions.

Wastewater Characterization: Sampling, significance, techniques and frequency. Physical, Chemical and Biological characteristics, Numerical on BOD.

Design based Problems (DP)/Open Ended Problem: Analysis of Sullage and Sewage quality at different places, for Compliance check with disposal standards.

(7 Hours)

Module – 4

Treatment of Waste Water: Flow diagram of Municipal Wastewater Treatment Plant. Preliminary & Primary treatment: Screening, Grit Chambers, Skimming Tanks, Primary Sedimentation Tanks. (Numerical to be solved)

Suspended growth and fixed film bioprocess. Trickling Filter – theory and operation, types and designs. Activated Sludge Process- Principle and flow diagram, Modifications of ASP, F/M ratio. (Numerical to be solved)

Sludge treatment & disposal methods.

Self-Learning Component: Newer Intervention in Fecal Sludge Management

(Teaching Pedagogy - Industrial Visits.)

(8 Hours)

Module – 5

Low-cost wastewater treatment methods: Septic tank, Oxidation Pond and Oxidation ditches, Anaerobic & Facultative Stabilization Ponds.

Disposal of Effluents: Disposal of Effluents by dilution, self-purification phenomenon. Oxygen Sag Curve, Zones of Purification, Sewage Farming, Sewage Sickness, Effluent Disposal standards for land, surface water Disposal of Effluents. Streeter Phelps equation.

Health Considerations at Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs.

Self-Learning Component: Latest Innovative developments in Wastewater Treatment.

Summary of the Course.

(9 Hours)

Question paper pattern:

- **SEE** will be conducted for 100 marks.
- **Part A:** First question with 20 MCQs carrying 1 mark each.
- **Part B:** Each full question is for 16 marks. (Answer five full questions out of 10 questions with intra modular choice). In every question, there will be a maximum of three sub-questions.
- **CIE** will be announced prior to the commencement of the course.
- 25 marks for test. Average of three tests will be taken.
- 25 marks for Alternate Assessment Method.

Course Outcomes: The students will be able to:

CO1: Appraise 'need-based' pre-requisites and components for setting up a "Protected Water Supply Scheme".

CO2: Analyze the Principles of Public Health Engineering to develop various physical, chemical, and biological environmental systems for a Water Supply Scheme.

CO3: Appraise 'need-based' pre-requisites and components for setting up a "Sanitary Engineering Systems".

CO4: Analyze the Principles of Public Health Engineering to develop various physical, chemical, and biological environmental systems for a Wastewater Treatment Scheme.
CO5: Assess wholistic applicability and feasibility of environmental systems and treatment techniques for any naturally and anthropogenically driven water pollution.
CO6: Identify latest techniques and developments in Water Supply and Sanitary Engineering.

Textbooks:

1. S. K. Garg, Environmental Engineering, Vol - I & II, Water Supply Engineering, 18th Edition, M/s Khanna Publishers, New Delhi, 2007.
2. B. C. Punmia and Ashok Jain, Environmental Engineering I &II - Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2010.
3. Howard S. Peavy, Donald R. Rowe, George T., Environmental Engineering, McGraw Hill, International Edition, New York, 2000.
4. Metcalf & Eddy, Waste Water Engineering: Treatment & Reuse, 4th Edition, McGraw Hill Education, 2003.

References:

1. Hammer. M.J., Water and Waste Water Technology, 7th Edition, Pearson, 2011.
2. CPHEEO, Manual on Water Supply and Treatment", Ministry of Urban Development, New Delhi, 1999.
3. APHA, Standard Methods for the Examination of Water and Wastewater, 21st Edn. American Public Health Association, Washington DC, 2005.

B.E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – IV

Engineering Surveying (2:1:0) 3 (Effective from the academic year 2021-2022)			
Course Code	21CV47	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:1:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Apply the basic principles of engineering surveying and measurements
2. Familiar with the data recording, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods,
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.
4. Calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses,

Module – 1

Introduction to Surveying: Importance of surveying in Civil Engineering, Concepts of plane and geodetic surveying Principles of surveying, Plans and maps, Surveying equipment's, Meridians, Bearings, Dip, Declination, Local attraction, Calculation of bearings and included angles. Compass surveying and Plane Table Surveying Compass surveying: Prismatic and surveyor's compasses, temporary adjustments. Plane Table Surveying: plane table and accessories, advantages and disadvantages of plane table survey, method of plotting - radiation, intersection, traversing, resection, two point and three-point method.

(8 Hours)

Module – 2

Levelling: Principles and basic definitions, Types of Levels, Types of adjustments and objectives. Types of levelling: Simple, Differential, Fly, Reciprocal, Profile, Cross sectioning. Booking of levels: Rise & fall and H. I methods (Numerical) Areas and volumes: Measurement of area by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpsons one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes-trapezoidal and prismoidal formula.

(8 Hours)

Module – 3

Theodolite Surveying: Theodolite and types, fundamental axes and parts of theodolite, temporary adjustments of transit theodolite, Horizontal and Vertical angle measurements by repetition and reiteration Trigonometric levelling: Single and Double plane for finding elevation of objects Computation of distances and elevations using Tacheometric method.

(8 Hours)

Module – 4

Curve Surveying: Curves, Necessity, Types, Simple curves, Elements, Designation of curves, setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankine's deflection angle method (numerical problems). Transition curves Characteristics, numerical problems on Length of Transition curve, Vertical curves, Types (theory).

Total Station Surveying: Principle, Specifications, Instrument Setup, Capabilities of a Total Station, Errors, Calibration, Types of total station, Advantages, Limitations and Applications.

EDM: Principle, Type of EDM instruments, advantages and applications

Drone Surveying: Principle, Specifications, Setup, fixing ground control points, flying height factor, data downloading and processing, Limitation and applications.

(8 Hours)

Module – 5

Photogrammetry and aerial survey: Introduction, definitions, basics principles, methods, importance of scale, height, applications. Remote sensing: Introduction, Principle of Remote sensing, EMR, types, resolutions, types of satellites, type of sensors, LIDAR, visual and digital image processing and its applications. Global Positioning System: Definition, Principles of GPS and applications. Geographical Information System: Introduction and principle of Geographical Information System, components of GIS, applications Advanced instrumentation in surveying: classification, measuring principles, electronic theodolite.

(8 Hours)

Course outcomes:

The students will be able to:

CO1: Apply the concepts of mathematics to estimate the distance between any two points using conventional and modern instruments.

CO2: Assess the terrain condition and suggest methods to conduct the survey.

CO3: Examine the case studies for evaluating the importance of surveying in any construction project and suitable economic methods for survey.

CO4: Understand the basic concepts and components of GIS, the techniques used for storage of spatial data and data compression.

CO5: Understand the concepts of spatial data quality and data standard.

Question paper pattern:

- **SEE** will be conducted for 100 marks.
- **Part A:** First question with 20 MCQs carrying 1 mark each.
- **Part B:** Each full question is for 16 marks. (Answer five full questions out of 10 questions with intra modular choice). In every question, there will be a maximum of three sub-questions.
- **CIE** will be announced prior to the commencement of the course.
- 25 marks for test. Average of three tests will be taken.
- 25 marks for Alternate Assessment Method.

Textbooks:

1. B.C. Punmia,"Surveying and Levelling Vol.1, 2 and 3",Laxmi Publications. Ltd. New Delhi–2016.
2. Bhavikatti, S.S, Surveying and Levelling, K. International, Vol. I and II, I. 2010.
3. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2017.
4. Kanetkar T P and S V Kulkarni, Surveying and Levelling Part I, Pune Vidyarthi Griha Prakashan, 1988.
5. Lillesand, T. M. and Kiefer R.W. Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2002.
6. S. K. Duggal, Surveying Vol.I & II, McGraw Hill Education; Fourth edition (2017).
7. R. Subramanian, Surveying and Levelling, Oxford University Press; 2nd edition, 2012.
8. Schofield and Breach, Engineering Surveying, 6th Edition, Butterworth-Heinemann Elsevier publication, 2007.

Reference Books:

1. S. K. Duggal, "SurveyingVol.1",Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. 2009.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.
3. Anji Reddy, Remote sensing and Geographical information system, B.S. Publications, 2001.
4. Chandra, A.M, Higher Surveying, New Age International (P) Limited, Third Edition, 2002.
5. K.R.Arora, "SurveyingVol.1" Standard Book House, New Delhi.–2010.

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Surveying Practice Laboratory (0:0:1) 1 (Effective from the academic year 2021-22)			
Course Code	21CVL48A	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Operate an automatic level to perform differential and profile levelling; properly record notes; mathematically reduce and check levelling measurements,
2. Effectively communicate with team members during field activities; identify appropriate safety procedures for personal protection; properly handle and use measurement instruments.
3. To identify hazardous environments and take measures to insure one's personal and team safety,
4. To Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station.
5. Work as a team member on a surveying party to achieve a common goal of accurate and timely project completion,
6. Calculate, design and layout horizontal and vertical curves, Understand, interpret, and prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities.

Part A – Basic Surveying

1. Setting out layout of building planes using survey instruments.
2. Marking centre line marking for column footings.
3. To determine the difference in elevation between two points by differential levelling using Dumpy level.
4. To find the difference in elevation between two points situated far apart by using reciprocal levelling.
5. Measurement of horizontal angle using Theodolite by: (i) Method of Repetition and (ii) Reiteration method.
6. Measurement of distance and area using Plane Table survey by Radiation and Intersection method.

Part B – Advanced Surveying

1. Trigonometrical levelling: Single plane method and Double plane method using Theodolite.
2. Setting a simple circular curve: Instrumental method using Theodolite.
3. Determination of the distance between two in-accessible points.
4. Determination of area using Total Station.
5. Determination of remote height using Total Station.
6. Contour survey using Total Station.

Course outcomes:

The students will be able to:

CO1: Work as an individual or as a team and accomplish the experimental and analytical tasks

CO2: Analyse and interpret the results obtained from the experiments and draft the complete report.

CO3: Communicate the significance of the experiments with respect to the ethical and feasibility components.

Examination pattern:

- **SEE** will be conducted for 3 hours.
- **Two** experiments, one from **Part A** and one from **Part B** has to be completed.
- Questions for Part A and Part B is given on a lotto basis and oral viva-voce is conducted.
- In **Record** and in **CIE**, for each experiment the weightage of marks is as follows,
  (i) Aim, Procedure and writeup- 15% marks
  (ii) Conducting the practical including calculation, graphs and results – 70% marks
  (iii) Viva- Voce- 15% marks

Note:

- In CIE and SEE, if there is change of experiment then subsequently 15% marks with respect to aim, write up and procedure shall be deducted.
- CIE can have the similar QP pattern as SEE and shall be accordingly evaluated.

Textbooks

1. Bhavikatti, S.S, Surveying and Levelling, K.International, Vol. I and II, I. 2010.
2. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
3. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2002.

Reference Books:

1. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.
2. Anji Reddy, Remote sensing and Geographical information system, B.S. Publications, 2001.
3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 2003
4. C.P. Lo Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems (GIS), Prentice Hall of India Publishers, 2006.

Computer Aided Building Planning and Drawing (0:0:1) 1
(Effective from the academic year 2021-22)

Course Code	21CVL48B	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

List of Experiments

PART A

Introduction to Course: Significance and applications of the CAD in Civil Engineering.

CAD drawing tools : Lines, Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings.

Drawings of Building Elements:

1. Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
2. Different types of bonds in brick masonry
3. Different types of staircases – Dog legged and Open well stairs.
4. Lintel and chajja.
5. Slabs and beams.
6. Steel truss.
7. Septic Tank and sedimentation Tank.
8. Layout plan of Rainwater harvesting and recharging system.
9. Cross sectional details of a road for a Residential area with provision for all services.

(20 Hours)

PART B

Building Drawings:

Principles of planning, planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of plan, elevation and section of buildings including electrical, plumbing and sanitary services using CAD

software for:

1. Residential building; 2. Commercial Building; 3. Hospital building. 4. School building.

Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws

(20 Hours)

Course outcomes:

The students will be able to:

CO1: Work as an individual or as a team and accomplish the experimental and analytical tasks

CO2: Analyse and interpret the results obtained from the experiments and draft the complete report.

CO3: Communicate the significance of the experiments with respect to the ethical and feasibility components.

Examination pattern:

- **SEE** will be conducted for 3 hours.
- **Two** experiments, one from **Part A** and one from **Part B** has to be completed.
- Questions for Part A and Part B is given on a lotto basis and oral viva-voce is conducted.
- In **Record** and in **CIE**, for each experiment the weightage of marks is as follows,

(i) Aim, Procedure and writeup- 15% marks
(ii) Conducting the practical including calculation, graphs and results – 70% marks
(iii) Viva- Voce- 15% marks

Note:

- In CIE and SEE, if there is change of experiment then subsequently 15% marks with respect to aim, write up and procedure shall be deducted.
- CIE can have the similar QP pattern as SEE and shall be accordingly evaluated.

Textbooks:

1. 1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing" , Tata McGraw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, "Civil Engineering Drawing", Asian Publishers/Computech Publications Pvt Ltd.

References:

1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.
2. IS: 962-1989 (Code of practice for architectural and building drawing).
3. National Building Code, BIS, New Delhi.

B.E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER - IV

Engineering Geology Laboratory (0:0:1) 1
(Effective from the academic year 2021-22)

Course Code	21CVL48C	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	3

Course Objectives:

This course will enable students to:

1. To identify the physical properties of rocks, minerals and their applications in civil engineering.
2. To gain the knowledge of rocks and minerals as a building and raw materials.
3. To provide information on dynamic structural Geology and its importance in different civil engineering projects (Dam, Road, Tunnels,)
4. To educate the ground water management regarding diversified different geological formations and climate.
5. To comprehend the application of Remote Sensing and GIS, Natural disaster and Management and environmental awareness.

LIST OF EXPERIMENTS

PART A

1) Physical properties of minerals, megascopic identification, uses
   a) Rock Forming minerals - Quartz group (Glass), Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Asbestos, Calcite, Gypsum, Carbonate Group (Cement)
   b) Ore forming minerals- Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, Kaolin (Paper, paint and textile); Bauxite (aluminum); Chalcopyrite (copper). Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Asbestos (AC sheets).
2) Megascopic identification and description of rocks:
   a) Igneous rocks- Types of Granites, Dolerite, Granite Porphyry, Basalt, Pumice etc.
   b) Sedimentary rocks- Sandstone, Lime stone, Shale, Laterite, Breccia etc.
   c) Metamorphic rocks- Gneiss, Slate, Schist, Marble, Quartzite etc.

PART B

1) Borehole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs and mining.
2) Dip and Strike problems: Determine apparent dip and strike direction in Civil Engineering projects (Railway lines, tunnels, dams, reservoirs)
3) Calculation of Vertical, True thickness and width of the outcrops True thickness and width of the outcrops.
4) Interpretation of toposheet: Extraction of Micro / major watershed basin and selecting suitable site for civil Engineering Projects.
5) Interpretation and drawing of Cross Sections for geological maps showing faults, folds, unconformities for suitability of subsurface investigation for Dams and Tunnels
6) Interpretation of Electrical Resistivity curves data for Groundwater, Geological, Geotechnical and Aquifer investigations.
7) Remote Sensing & GIS: Projections, Geo-referencing, Satellite Image interpretations, Digital Image Processing, Attribute Data. Geospatial Analysis through QGIS software.

Course outcomes:

The students will be able to:

CO1: Perform as an individual or as a team the experiments relevant to rock mechanics, applied geology, remote sensing and GIS.

CO2: Analyze and interpret the results obtained from the experiments and draft the report.

CO3: Communicate the implication of the experiments and purposes to the society.

Examination pattern:

- **SEE** will be conducted for 3 hours.
- **Two** experiments, one from **Part A** and one from **Part B** has to be completed.
- Questions for Part A and Part B is given on a lotto basis and oral viva-voce is conducted.
- In **Record** and in **CIE**, for each experiment the weightage of marks is as follows,

(i) Aim, Procedure and writeup- 15% marks
(ii) Conducting the practical including calculation, graphs and results – 70% marks
(iii) Viva- Voce- 15% marks
Note:

- In CIE and SEE, if there is change of experiment then subsequently 15% marks with respect to aim, write up and procedure shall be deducted.

CIE can have the similar QP pattern as SEE and shall be accordingly evaluated.

Textbooks:

1. P.K. Mukerjee, A Text Book of Geology, World Press Pvt., Ltd. Kolkata, 2004
2. Parbin Singh, Text Book of Engineering and General Geology, Published by S.K.Kataria and Sons, New Dehli, 2008.

Reference:

1. D. Venkata Reddy, Engineering Geology, New Age International Publications, New Delhi, 2006.
2. M.P Billings, Structural Geology, CBS Publishers and Distributors, New Delhi, 2000.
3. K V G K Gokhale, Principles of Engineering Geology, B S Publications, Hyderabad, 2001.

B.E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER - IV

Diploma Mathematics- II (0:0:0) NIL

COMMON TO ALL BRANCHES

(Effective from the academic year 2021-22)

Course Code	21DIP41A	CIE Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	-
Total Number of Contact Hours	3	Exam Hours	3

Course Objectives:

This course will enable students to:

1. To provide an insight into linear & higher order ODE's and elementary probability theory.
2. To familiarize the important tools of Laplace transformations required to analyse the engineering problems.

Module – I

Introduction: Understanding the importance of Vector Differentiation, Differential equations, Laplace Transforms and Probability in the field of Science, Engineering, Business and Research.

Differential equations–I: Introduction-solutions of first order and first-degree differential equations: exact, Equations reducible to exact, linear differential equations and Bernoulli's equation.

(6 hours)

Module – II

Differential equations–II: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous/non-homogeneous equations. Inverse differential operators. [Particular Integral restricted to $R(x)= e^{ax}$, sin ax, cos ax, polynomial for $f(D)y = R(x)$].

(6 hours)

Module – III

Probability: Introduction to Probability, Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem, problems.

(6 hours)

Module – IV

Laplace Transforms: Definition and Laplace transforms of elementary functions, Laplace Transforms of e^{at} f(t), t^nf(t), n is a positive integer & (f(t))/t (without proof), Periodic function (statement only) and Unit-step function – problems.

(6 hours)

Module – V

Inverse Laplace Transforms: Inverse Laplace Transform- Definition and problems, Convolution theorem (No Proof), Evaluation of Inverse Laplace Transform using Convolution theorem. Solution of linear differential equations using Laplace transforms technique.

Recap/Summary of the course.

(6 hours)

Course outcomes: The students will be able to:

CO1: Solve first and higher order ordinary differential equations.

CO2: Use Laplace transform and inverse Laplace transform in solving differential equation.

CO3: Apply elementary probability theory for related problems.

Question paper pattern:

CIE will be announced prior to the commencement of the course.

- 75 marks for test. Average of three tests will be taken.
- 25 marks for Alternate Assessment Method.

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2015.
2. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2015.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2010.

References:

1. N. P. Bali, Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publishers, 2014.
2. C. Pandurangappa, Advanced Mathematics II (Lateral entry bridge course text book)", 3rd Edition. Sanguine Publishers, 2015.
3. S. Pal, S. C. Bhunia, Engineering Mathematics, 3rd Edition, Oxford University Press, 2011.
4. H. K. Dass, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Private Ltd, 2014.