

Program name

**BACHELOR OF ENGINEERING
CIVIL ENGINEERING**

**Program code
619112**



**Department of Civil Engineering
Faculty of Technology and Engineering
The Maharaja Sayajirao University of Baroda
Vadodara**

Titles of Courses and Detailed Syllabi

w.e.f. 2022-23

B.E. SEM-I [FSBE-I] & SEM-II [SSBE-I]
B.E. SEM-I [FSBE-II] & SEM-II [SSBE-II]
B.E. SEM-I [FSBE-III] & SEM-II [SSBE-III]
B.E. SEM-I [FSBE-IV] & SEM-II [SSBE-IV]

Sr. No	Subject Code	Subject Title	Page No.
F.S. B.E.-I	ENG1002CS	Communication Skills	
	ENG1002LCS	Communication Skills Lab	
	AMT1106CS	Applied Mathematics – I	
	MEC1106CS	Engineering Drawing	
	MEC1106LCS	Engineering Drawing Lab	
	CVL1108CS	Fundamental of Civil and Environmental Engg.	
	CVL1108LCS	Fundamental of Civil and Environmental Engg. Lab	
	MEC1116LCS	Workshop Practice	
	MME1105CS	Material Science	
	FTE1101CS	Universal Human Values I	
S.S. B.E.-I	CVL1210CS	Surveying-I	
	CVL1210LCS	Surveying-I Lab	
	APH1209CS	Applied Physics	
	APH1209LCS	Applied Physics Lab	
	APM1206CS	Applied Mechanics	
	APM1206LCS	Applied Mechanics Lab	
	MEC1213CS	Fundamental of Mechanical Engg.	
	AMT1212CS	Applied Mathematics-II	
F.S. B.E.-II	CVL1306CS	Building Drawing and Design	
	CVL1306LCS	Building Drawing and Design Lab	
	APM1318CS	Numerical Methods and Computer Application	
	APM1318LCS	Numerical Methods and Computer Application Lab	
	APM1309CS	Mechanics of Materials	
	APM1309LCS	Mechanics of Materials Lab	
	ELE1320CS	Electrical Engineering Fundamentals	
	ELE1320LCS	Electrical Engineering Fundamentals Lab	
	AMT1312CS	Applied Mathematics III	
S.S. B.E.-II	CVL1409CS	Surveying – II	
	CVL1409LCS	Surveying – II Lab	
	CVL1410CS	Construction Technology	
	APM1415CS	Concrete Technology & Elementary RCC	
	APM1415LCS	Concrete Technology & Elementary RCC Lab	
	CVL1412CS	Hydraulic Engineering	
	CVL1412LCS	Hydraulic Engineering Lab	

	APM1416CS	Applied Geology and Geotechniques	
	APM1416LCS	Applied Geology and Geotechniques Lab	
	FTE1401CS	Universal Human Values II	
F.S. B.E.-III	APM1501CS	Theory of Structures	
	APM1501LCS	Theory of Structures Lab	
	APM1502CS	Geotechnical Engineering	
	CVL1502CS	Estimation and Costing	
	CVL1502LCS	Estimation and Costing Lab	
	CVL1505CS	Engineering Hydrology	
		Elective I	
	APM1551DECS	Fundamentals of Structural Dynamics	
	APM1552DECS	Advanced Concrete Technology	
	APM1553DECS	Advanced Foundation Engineering	
	CVL1551DECS	Construction & Road Safety	
	CVL1552DECS	Circular Economy	
	CVL1553DECS	Climate Resilient Cities	
	CVL1554DECS	Advanced and Sustainable Construction	
S.S. B.E.-III	APM1610CS	Fundamentals of structural Design	
	APM1610LCS	Fundamental of structural design Lab	
	CVL1609CS	Environmental Engineering	
	CVL1609LCS	Environmental Engineering Lab	
	CVL1614CS	Basic Transportation System	
	CVL1615CS	Construction Planning & Management	
	CVL1615LCS	Construction Planning & Management Lab	
		Elective-II	
	CVL1651DECS	Transportation Planning	
	CVL1652DECS	Ground Water Engineering	
	CVL1653DECS	Professional Practice and Valuation	
	CVL1654DECS	Air Pollution Control Engineering	
	APM1651DECS	Advanced Structural Analysis	
	APM1652DECS	Prestressed Concrete	
	APM1653DECS	Matrix Analysis of Framed Structures	
		Institution/Open Elective/Online courses	
	CVL16XXIECS	Circular Economy and Sustainable development (Institution/Open Elective/Online courses offered by civil Engg. dept)	
	CVL16XXIECS	GIS and Remote Sensing (Institution/Open Elective/Online courses offered by civil Engg. dept)	
F.S. B.E.-IV	CVL1701CS	Water Resources and Irrigation Engineering	
	CVL1701LCS	Water Resources and Irrigation Engineering Lab	
	CVL1702CS	Water and Wastewater Treatment	
	CVL1702LCS	Water and Wastewater Treatment TW, Pr & Viva	
	CVL1703CS	Highway & Airport Engineering	
	CVL1703LCS	Highway & Airport Engineering. TW, Pr & Viva	
	APM1701CS	Design of RCC and Steel Structures	

	APM1701LCS	Design of RCC and steel structures TW, Pr & Viva	
		ELECTIVE III	
	CVL1704CS	Pavement Design and Construction	
	CVL1704LCS	Pavement Design and Construction Lab	
	CVL1705CS	Advanced Water and Wastewater Treatment	
	CVL1705LCS	Advanced Water and Wastewater Treatment Lab	
	CVL1706CS	Advanced Fluid Mechanics	
	CVL1706LCS	Advanced Fluid Mechanics Lab	
	CVL1707CS	GIS Application in Civil Engineering	
	CVL1707LCS	GIS Application in Civil Engineering Lab	
	APM1702CS	Advanced Design of Reinforced Concrete Structures	
	APM1702LCS	Advanced Design of Reinforced Concrete Structures Lab	
	APM1703CS	Advanced Design of Steel Structures	
	APM1703LCS	Advanced Design of Steel Structures Lab	
	APM1704CS	Advanced Programing in Structural Engineering	
	APM1704LCS	Advanced Programing in Structural Engineering Lab	
S.S. B.E.-IV	CVL1801LCS	Project	
	CVL1802LCS	Internship	

 सत्यं शिपं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23
B. E. Civil : Regular Program			
Year	I	COMMUNICATION SKILLS + COMMUNICATION SKILLS LAB	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : ENG1002CS & ENG1002LCS
Mode of Transaction		Lectures: 02 Practical: 01	Credit /Hours per week: 2.5/03
Course Outcome (CO) CO1 To know the process of communication and its components. CO2 To improve the language skills i.e. Listening Skills, Speaking Skills, Reading Skills and Writing Skills (LSRW). CO3 To effectively conduct meetings and conferences CO4 To enhance phonetic competence, comprehension skills, presentation skills, group discussion skills etc. CO5 To build confidence for communicating in English and create interest for the life-long learning of English language.			
Unit No.	Topic/Unit		
1	Communication skills: Process of communication, Flows of Communication in organization, Barriers to communication (Formal Flow – Upward, Downward, lateral and diagonal, Strategies to improve Organizational Communication, Effectiveness in Managerial Communication, and importance of technical communication, Non verbal communication.		
2	Listening Ability, Hearing and Listening, Types of Listening, Barriers to Effective Listening, Traits of a Good Listener.		
3	Presentation Skills and Writing skills: Effective Presentation strategies: Purpose, analyzing the audience and locale, organizing the content, Oral presentation, Graphic presentation, Presentation aids, Personality Development. Newsletters, technical article and business letters. Technical Reports, characteristics, Importance, objectives, categories of report, format structure of reports, types of reports, importance of plagiarism check.		
4	Group Discussion and work place communication: Qualities needed for effective group discussion. Email etiquettes, Telephone Etiquettes, Role and responsibility of engineer, Work culture in jobs. Work place, rights and responsibilities		
5	Interviews and meetings: Types of interview, General preparation for interview, Gathering information about the company, knowing about the role/job position, Types of interviewing questions, Non-verbal communication to win the interview. Meeting and Conferences: Planning a meeting (Agenda and notice), Conducting a meeting, Post meeting actions (Minutes), Planning & Conducting a Conference (anchoring and Report writing), and Video/web conferences		
T.W./ Pr.	Term work / Practicals shall be based on above syllabus.		
Reference Books			
1.	G. S. B. K Babu Rao, “Business Communication and Soft Skill”, Himalaya Publishing house (1st Edition)		
2.	Raman Sharma, “Technical Communications”, Oxford Publication, London, 2004		
3.	R. Sharma, K. Mohan, “Business Correspondence and Report Writing”, TMH New Delhi 2002.		
4.	S. Kumar, P. Lata, “Communication Skills”, New Delhi, Oxford University Press, 2011		

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering	Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23	
B. E. Civil : Regular Program			
Year	I	APPLIED MATHEMATICS-I-CVL	
Semester	I	Type of Subject Core-/ Elective / Foundation	Subject Code : AMT1106CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO)			
CO1 Evaluate successive differentiation of given function and solve identities involving higher order derivatives, evaluate radius of curvature, obtain Taylor & Maclaurin series expansion of function of single variable. Evaluate limits of indeterminate forms.			
CO2 Test for convergence sequences and positive term series using various tests like comparison test, ratio test. Also find the convergence, absolute and conditional convergence for alternating series.			
CO3 Understand the requirement of complex numbers their various representations, Demovier's theorem and its applications. Logarithm of complex numbers. Evaluate and use circular functions, hyperbolic functions.			
CO4 Classify the differential equations with respect to their order and linearity, explain the meaning of different types of solutions of a differential equation.			
CO5 Identify and solve the 1 st order differential equations.			
CO6 Apply the method of undetermined coefficients to solve the non-homogeneous linear differential equations with constant coefficients.			
CO7 Apply the method "variations of parameters" to find to solution of higher-order linear differential equations with variable coefficients.			
CO8 Solve the Cauchy-Euler equations and systems of linear differential equations .			
CO9 Analyze real-world problems in field of Engineering like problems related to bending of beams, mixtures, growth and decay, heating and cooling, electric circuits, Spring-mass system etc.			
CO10 Find series solutions of Bessel differential equation and Legendre's differential equations and make use of the properties of Bessel's functions and Legendre polynomials to study and analyze the			
Unit No.	Topic/Unit		
1	Calculus: Reorientation, Functions of one variable Application of derivatives, Curvature, Successive differentiation, Partial derivatives, Leibnitz rule for the nth order derivative of a function		
2	Infinite Series: Sequence and their convergence, convergence and divergence of infinite series, Geometric series, P – Series, Necessary condition for convergence, Comparison test, ratio test Absolute convergence and conditional convergence of alternating series, Maclaurin's & Taylor's expansion with reminder form, Indeterminate forms L'Hospital's rule		
3	Complex Numbers: Complex numbers & their geometrical representation, Complex numbers in polar form, Demoivre's theorem and its applications, Exponential, logarithmic, trigonometric & hyperbolic functions.		
4	Differential Equations: Reorientation, Modeling of engineering systems pertaining to first order differential equations, Exact differential equations, integrating factors, Unified approach to first order ordinary differential equations, Equations of first order and higher degree.		
5	Linear differential equations of higher order with constant coefficients and with variable coefficients Models of higher order differential equations, Method of variation of parameters and Method of undetermined coefficients		
6	Bessel and Legendre's equations, Properties of Bessel functions Introduction to Legendre polynomials		
Reference Books			
1.	Erwin Kreyszing	Advanced Engineering Mathematics, (6th edition) Johnwiley&Sons.,1988	
2.	Donald Greenspan	Introduction to Partial Differential Equations, Mc. Graw – Hill Inc., 2012	
3.	C. R. Wylie	Advanced Engineering Mathematics, Mc. Graw – Hill Inc., 1986	
4.	G. B. Thomas, R. L. Finney:	Calculus and Analytic Geometry, Addison-Wesley Publishing Co., 2010	
5.	J. W. Brown, R.V. Churchill:	Complex variables and Applications, McGraw-Hill Higher Education, 2013.	
6.	P. V. O'Neil	Advanced Engineering Mathematics, Cengage Learning (India edition), 1991.	
7.	B. V. Ramana	Higher Engineering Mathematics, Tata Mc. Graw – Hill. (Core Engineering Series), 2006.	

8.	David V. Widder	Advanced Calculus, Prentice Hall of India Pvt. Ltd., 1986.
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	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23
B. E. Civil : Regular Program			
Year	I	ENGINEERING DRAWING-CVL	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : MEC 1106CS
Mode of Transaction		Lectures: 03	Credit /Hours per week: 03/03
Course Outcome (CO)			
CO1 Use the drawing instruments effectively and how to use the dimensioning methods.			
CO2 Observe, analyze and correlate two-dimensional (Orthographic view) and three dimensional (Isometric view)			
CO3 Construct and application of various engineering curves in engineering practice.			
CO4 Apply the knowledge of Projection of points, Lines and Planes in engineering.			
CO5 Understanding of solids and its sections with its true shape			
Unit No.	Topic/Unit		
1	Introduction to Engineering Drawing: Introduction to ISI & ISO standards in drawing practice, Drawing instruments and their uses, Types of lines, lettering and dimensioning, construction of scales		
2	Engineering Curves: Classification of Engineering Curves, Construction of conics, cycloidal curves, involutes and spirals along with normal and tangent to each curve, Applications of all curves		
3	Projection of Point and Lines Introduction to principal planes of projections, projections of points located with respect to reference planes (in different quadrants), projection of line parallel and inclined to one or more reference planes, methods of finding true length and traces		
4	Projection of Planes Types of planes, projections of planes (polygons, circles etc) parallel, perpendicular and inclined to one or two reference planes, projection of planes inclined to one or two reference planes, concept of auxiliary planes		
5	Orthographic projection Principles and Methods of projection, First angle projection, Third angle projection, half and full sectional views		
6	Isometric Projections: Isometric axes, lines and planes, construction of isometric scale, isometric view and isometric projection		
7	Projection and Section of Solids: Classification of solids (polyhedra and solids of revolution), Projection of solids and their frustum with axes parallel or inclined to one or more reference planes, concept of auxiliary inclined plane (AIP) and auxiliary vertical plane (AVP), section of solids and true shape of the sections		
Reference Books			
1.	Bhatt, N.D., ‘Engineering Drawing’,		
2.	Shah, P. J., ‘Engineering Drawing’,		

 मय्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23
B. E. Civil : Regular Program			
Year	I	ENGINEERING DRAWING-TW&PR/Viva-CVL	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : MEC1106LCS
Mode of Transaction		Drawing Work: 04	Credit /Hours per week: 02/04
Unit No.	Topic/Unit		
1.	Lines, lettering, and dimensioning		
2.	Engineering Curves		
3.	Orthographic projection		
4.	Isometric projection		
5.	Projection of Lines		
6.	Projection of planes		
7.	Projection and Section of Solids		

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23
B. E. Civil : Regular Program			
Year	I	FUNDAMENTALS OF CIVIL AND ENVIRONMENTAL ENGINEERING-CVL	
Semester	I	Type of Subject Core- / Elective / Foundation	Subject Code : CVL1108CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO)			
CO1 To impart brief fundamental concept related to various materials and their use in building construction			
CO2 To study environmental pollution comprehensively and			
CO3 Students will know concept of linear and angular measurements			
CO4 Students will be aware of various constructional practices			
Unit No.	Topic/Unit		
1	Building Material		
	Stone - Introduction to stone – Uses of stone – Characteristics of good building stone – Availability, suitability and properties of different stone. Bricks - Comparison between stone work and brick work – Advantages of bricks – Characteristics of good brick – Standard test for brick along with field test for brick. Lime - Classification of Lime, Precautions in handling Lime. Cement - Basic ingredient of ordinary cement – Physical properties of cement – Field examinations of cement – Storing of cement and its uses. Timber - Introduction to timber – Importance of seasoning – Wood base product. Steel - Introduction – Use of different form of steel – Marketable forms of steel. Aggregates. Bitumen. FRP. Optical fiber. Plastic - Properties of plastics – Types and uses of plastic.		
2	Environmental Science and Sustainable Development		
	Introductory Environmental Engineering Terminology— Introduction to various types of pollution- Water and land pollution and remedial measures for control, water and wastewater quality criteria – Disposal of wastes – Air pollution and remedial for control – Ecology, Environmental Protection and legislation. Hydrologic cycle, Rain water harvesting, Green building, Solid waste management, Environment Impact Assessment, Basic environmental chemistry, Sustainable development – clean development mechanism, Global warming, Ozone layer depletion, Acid rain, and Climate change.		
3	Surveying and Leveling		
	Surveying - Introduction – Principle – Object of survey – Classification – Basic instruments of linear and angular measurements – chain, tape, Offsetting, Types of offsets, Ranging methods. Prismatic compass, Types of meridians, Types of bearings. Traverse survey: open and closed Examples based on compass. Leveling – Definitions – Computation of reduced levels– Introduction to contour, Methods of leveling and Examples on Level. Modern tools: Introduction to Theodolite, Total station – Introduction to GPS, GIS, Remote sensing.		
4	Building Construction		
	Building Construction & Infrastructures: Types of constructions – roads, pipelines, transmission lines – Typical details of load bearing and framed structures – Brief discussion and illustrational sketches of typical important building components – Foundation – Functions, Types of foundations such as Spread footing, Stepped footing, Isolated and Combined column footing, Raft, and Grillage foundation. Lintels– Function, Types of lintel. Flooring, Roofing. Mortar and concrete specifications – Ingredients for mortar and concrete – classification of mortar and concrete – selection of mortar and its uses – precaution in using mortar – Pre-stressed concrete – grades of concrete, Internet of things for buildings, Hydropower plants.		
Reference Books			
1	Arora S.P. and Bindra S.P. (2012), A text book of Building Construction, Dhanpatai and Sons, Publishers.		
2	Rangwala S.C. (2012), A text book of Building Construction, Charotar Publishing House, India.		
3	Gilbert M Masters, (2006), Introduction to Environmental Engineering & Science, Prentice Hall of India Pvt. Ltd. New Delhi		
4	Deshpande P.D., (2009) Basic Civil Engineering, Nirali Prakashan Pune.		
5	G.S.Birdie, Water supply & Sanitary Engg., Dhanpatrai & Sons.		
6	S.C.Rangwala, Engg. Materials, Charotar Books Staff, Anand.		
7	Janardan Jha Building Material		

8	Surendra Singh, Building Material, Vikas Pub. Pvt. New Delhi.
9	D.N.Ghose, Material of Construction, Tata McGraw Hill Pub. Co. Ltd. New Delhi
10	Surveying & Levelling – Kanetkar & Kulkarni Vol-I A.V.G. Prakashan, Puna.
11	Elementary Survey – B.C.Punmia Vol-I. Laxmi Pub. Dariya Gunj, New Delhi.
12	Surveying & Levelling – S.C.Rangwala, Charotar Pub. House, Anand.

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23
B. E. Civil : Regular Program			
Year	I	FUNDAMENTALS OF CIVIL AND ENVIRONMENTAL ENGINEERING -TW/Viva- CVL	
Semester	I	Type of Subject Core -/ Elective / Foundation	Subject Code : CVL1108LCS
Mode of Transaction		Practicals: 02	Credit /Hours per week: 01/02
No.	Experiment		
1	Conventional signs and symbols, scale, topographic-sheet		
2	Linear measurements: tape, ranging, offsets		
3	Compass: Introduction, Bearings		
4	Auto level: Introduction, HI, Rise and fall		
5	GPS : Introduction, and demonstration		
6	Theodolite and Total Station demonstration		
7	Any other term-work based on syllabus		

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23
B. E. Civil : Regular Program			
Year	I	WORKSHOP PRACTICES	
Semester	I	Type of Subject Core- / Elective / Foundation	Subject Code : MEC1116LCS
Mode of Transaction		Practical : 04	Credit /Hours per week: 02/04
Course Outcome (CO) CO1 Understand importance of workshop practices along with safety precautions in different shops. CO2 Understand the basic operations of carpentry, fitting, smithy and molding shop by using various marking, measuring, cutting and inspection tools. CO3 Hands on practice and job making in carpentry, fitting, smithy and molding shop CO4 Understand various manufacturing operations in machine shop CO5 Understand different types of metal joining processes and perform basic operations of welding shop CO6 Perform basic operations on lathe and shaping machine in machine shop. CO7 Understand the basic operations of press working			
Unit No.	Topic/Unit		
1	Introduction to workshop facility: Introduction to different shops of the workshop, general safety guidelines, familiarization with workshop facility		
2	Carpentry Shop: Introduction to different tools of carpentry shop, understanding drawing of the job to be made, making of finished job as per drawing out of the given raw material of wood.		
3	Fitting Shop: Introduction to different tools of fitting shop, understanding drawing of the job to be made, making of finished job as per drawing out of the given raw material.		
4	Smithy Shop: Introduction to different tools of smithy shop, understanding drawing of the job to be made, making of finished job as per drawing out of the given raw material.		
5	Introduction to Machine Tools: Demonstration on different machine tools eg.Lathe machine, Shaping machine, Drilling machine, Grinding machine. Preparation of job by turning on lathe involving step turning and thread cutting.		
6	Metal Joining Processes: Introduction to different tools of welding shop, Demonstration of welding process, Preparation of welding job as per drawing, Introduction to other metal joining processes such as soldering, brazing and riveting		
7	Moulding Practice: Introduction to different tools of moulding shop, Demonstration of moulding process, Preparation of mould assembly as per pattern.		
8	Press Working: Demonstration of press working operations like blanking, punching, piercing etc.		
Reference Books			
1.	Workshop Technology-I. W.A. J. Chapman Taylor & Francis		
2.	Comprehensive Workshop Technology (Manufacturing Processes). S.K. Garg Laxmi publications		
3.	Workshop practice manual. K.Venkata Reddy B.S.Publications.		
4.	Workshop Technology-I. Hazra and Chaudhary Media promoters & Publisher private limited		

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23
B. E. Civil : Regular Program			
Year	I	MATERIALS SCIENCE-CVL	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : MME1105CS
Mode of Transaction		Lectures: 04	Credit /Hours per week: 04/04
Course Outcome (CO) CO-1: Understanding of materials and their classification CO-2: Study about crystals and lattices parameters CO-3: Understanding mechanical properties and behavior of these properties on engineering materials CO-4: Studies of phase important with their diagrams and materials defects CO-5: Learning about ceramics and glasses materials CO-6: Understanding briefly causes and types of corrosions and their protection methods CO-7: Study about electronics and electrical materials CO-8: Learn about some advanced materials and their uses			
Unit No.	Topic/Unit		
1	The basics of materials Materials classifications, basis for solid materials or arrangement of atoms, aggregation with metallic bonding, metal crystal structures, density of crystal, atomic packing factor, co-ordination nos., numerical		
2	A system for navigating crystals Miller Indices, determination of crystal lattice, crystallographic direction and planes.		
3	Imperfection in solids Classification of defects/imperfections, Point defects, line defects, area defects, volume defects and amorphism		
4	Amorphous and Semi-crystalline materials Amorphous, crystalline, semi crystalline structures and materials, Amorphous glasses, Polymers, Classification of polymers, Co-polymers, Rubbers, crystallization in polymers, liquid crystal polymers		
5	Mechanical Properties of Solid A material's response to load or forces, importance of mechanical properties as an engineer, Stress-Strain behaviors for different materials, hardness of materials, different types of loads and their dynamic affects on materials, Numericals		
6	Deformation versus Fracture Mechanical failure criteria in materials, Ductile and Brittle fracture, Plastic deformation in single crystal metals (the process of slip), and in polycrystalline metals (the role of grains and their morphology), Cold vs Hot working processes, strain Hardening, grain refinement		
7	Electrical Properties of Solids Importance of electrical properties for engineering / electric/electronic applications, the origin of materials conductivity-electron band theory, electron mobility, resistivity, semi-conductivity and semi-conductors, Super conducting materials		
8	Composite Materials Classification of composite materials, Role of the reinforcement and matrix phases in composites, Nano composites		
9	Environmental degradation of materials Environmental degradation of materials, chemistry of corrosion and erosion, types of corrosion (electrochemical cell and galvanic corrosion), factors affecting on corrosion and corrosion protection techniques		
Reference Books			
1.	Robert W. Messler, Jr., "The Essence of Materials for Engineers" , Jones & Bartlett Publishers (2011)		
2.	Raghavan V (2007), Materials Science and Engineering - A First Course, Prentice Hall, India		
3.	Hummel, Rolf E., "Understanding Materials Science: History, Properties, Applications", Springer (2004)		
4.	Askeland D.R., & P. P. Fullay (2007), The Science and Engineering of Materials –4th Cengage Learning Publishers		
5.	William D. Callister, Jr (2008), Callister's Materials Science and Engineering, (Adopted by R. Balasubramaniam) Wiley-Eastern		
6.	A.S. Edelstein and R.C. Cammarata Ed.(1998), Nano Materials: Synthesis, Properties and Applications, Inst. Of Physics Publishing, UK		
7.	James F. Shackelford (1996), Introduction to Materials Science for Engineers, Prentice Hall, India		
8.	Heather Dale, "The Science and Engineering of Materials", NY RESEARCH Press (2019)		

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Textile Engineering		Year of Introduction: 2024 Year of Syllabus Revision: -	
Year	I	UNIVERSAL HUMAN VALUES – I			
Semester	I	Type of Subject Core / Elective / Foundation		Subject Code : FTE1101CS	
Mode of Transaction		Lectures: 02		Credit /Hours per week: 00/02	
Mode of Transaction		Lectures (Online)			
Course Outcome (CO) CO1: Understand and analyse the essentials of human values and skills, self-exploration, happiness and prosperity. CO2: Evaluate coexistence of the “I” with the body. CO3: Identify and evaluate the role of harmony in family, society and universal order. CO4: Understand and associate the holistic perception of harmony at all levels of existence. CO5: Develop appropriate technologies and management patterns to create harmony in professional and personal lives.					
Unit No.	Topic/Unit				
1	Introduction to UHV, Aspirations and Concerns, Self-management, Health				
2	Relationships				
3	Society, Natural Environment, Self-evaluation				
Reference Books:					
1.	A foundation course in Human Values and Professional Ethics by R R Gaur, R. Ashthana and G P Bagaria, 2 nd Edition (2019).				
2.	Universal Human Values and Professional Ethics by Dr. Saroj Kumar, Prof. Sheenu Nayyer, Thakur Publication Pvt Ltd, (2020)				
3.	Online Universal Human Values material of AICTE.				

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B. E. Civil : Regular Program			
Year	I	APPLIED PHYSICS	
Semester	I	Type of Subject Core / Elective/ Foundation	Subject Code : APH1209CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Understand the basics of laws governing physical world CO3 Understanding the basics of sound and electro magnetic waves CO2 Understanding the basics of solar photo voltaic system CO4 Application of physical laws in various engineering applications			
Unit No.	Topic/Unit		
1	Electromagnetic Waves: – Basic laws and equations. Application for devices and instrumentation, Microscopes, Telescopes and camera, Resolution and magnifications, Optical vibration and correction.		
2.	LASER and Matter Waves: Fundamentals, Generation, Spontaneous and stimulated emission, conditions for lasing action, population inversion, Types and Engineering applications – Laser and electron beam machining and other instruments		
3.	Sound Waves: Sound waves characteristic and properties, Velocity, frequency, wavelength, intensity, loudness (expression), timber, reflection, echo, reverberation. Sabine’s formula, remedies over reverberation; Absorption of sound, absorbent materials; Criteria for good acoustics of a building; Ultrasonic: Production of ultrasonic waves, Detection of ultrasonics; Engineering applications of Ultrasonics (Non- destructive testing, Infrasound – Seismology (concept only))		
4	Solar cells Principle of working, conversion efficiency, Single, multi-junction solar cells, Photovoltaic system engineering, Thermo-photovoltaic generation in electricity, Concentration and storage of electrical energy, Photovoltaic – systems and applications		
5.	Introduction to physics of Buildings Heat transfer and air circulation in buildings, effects of thermal expansion		
Reference Books			
1.	Engineering Physics: by R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications (P) Ltd. 8 th Edition.		
2.	Modem Engineering Physics: by A. S. Vasudeva, S. Chand and Company Ltd.		
3.	Fundamentals of Physics: by D. Halliday, R Resnick and J. Walker, Asian Books Pvt. Ltd. 8 th Edition		
4.	Building Physics: Heat, Air and Moisture, 3 rd edition, Hugo S. L, Hens, Wiley		
5.	Stephen J. Fonash, “Solar Cell Device Physics”, 2 nd edition, Academic Press, 2003.		

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23
B. E. Civil : Regular Program			
Year	I	APPLIED PHYSICS TW,Pr & Viva-CVL	
Semester	I	Type of Subject Core-/ Elective / Foundation	Subject Code : APH1209LCS
Mode of Transaction		Lectures: 02 Tutorial: 01	Credit /Hours per week: 03/03
Course Outcome (CO) CO1 Understanding the optical instrument CO2 Understanding the physical properties through experiments CO3 Methods to determine physical properties CO4 Understanding of advances in instrumentation			
No.	Experiment		
1	Microscope: - To determine the average separation between consecutive wires of a given grid using travelling Microscope.		
2	Telescope: - To determine the resolving power of a given Telescope using the Releigh criteria of resolution		
3	Frequency of AC Mains: To determine the frequency of A. C. Mains.		
4	Sound Waves: - to determine the velocity of sound wave in air using resonance		
5	Ultrasonic Waves: To determine the frequency of Ultrasonic waves and find out the velocity of Ultrasonic wave in air medium by using the interference theory of longitudinal wave.		
6	Solar Cell: Study of I-V characteristics and determine the various parameter of given solar cell.		
7	Laser Parameters: To determine the full angular divergence of the given gas laser.		
8	Wavelength of Laser:- To determine the wavelength of the given laser source using diffraction		
9	Temperature Sensor: to study the nature of different temperature (NTC/PTC//Pt-100)		
10	Young’s Modulus: to determine the Young’s Modulus of a given object.		
References			
1	Engineering Physics: by R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications (P) Ltd. 8 th Edition.		
2	Fundamentals of Physics: by D. Halliday, R Resnick and J. Walker, Asian Books Pvt. Ltd. 8 th Edition		
3	Practical Physics, C.L. Arora S Chand Publications		

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B. E. Civil : Regular Program			
Year	I	SURVEYING-I	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : CVL 1210CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Understand and learn basic surveying. CO2 Understand, learn various methods of computation of area and volumes and operating of survey instruments. CO3 Understand and learn field survey and it's applications.			
Unit No.	Topic/Unit		
1	Different methods of leveling: LS and CS, Contouring; sources of error; curvature and refraction correction.		
2	Plane table and accessories: Adjustments, Different plotting methods, errors in plane table survey, two point and three point problem.		
3	Computation of areas and volumes : Boundary area, trapezoidal and Simpsons rule, Planimeter; Area by coordinates and LMD volume computation by LS,CS, Contour maps and spot levels.		
4	Study of Transit and optical Theodolite; Adjustment; Transit survey; Latitude and departure; Gale"s Traverse table; Numerical based on above.		
5	Tacheometry: Principle; Determination of constants; computation of distance and levels; Inclined sights; and Tangential tacheometry.		
6	Total station: Introduction, Components used in Total station, Types of Total station survey , Advantages and Disadvantages of Total station surveying.		
7	Hydrography: Introduction, Purposes, Control points, Sounding, Instruments & methods of locating soundings.		
8	Setting out works: Building , Culvert, Bridge, Tunnel		
Reference Books			
1.	Surveying and levelling- vol.I & II, Kanitkar and Kulkarni, Published by A.V.G. Prakashan, Pune-2		
2.	Surveying: - Vol.-I & II Dr. B.C.Punmia, Pub: Laxmi Publisher,New Delhi		
3.	Elementary Surveying : - S.K.Mahajan , pub: Dhanpatrai and sons, New Delhi.		
4.	Surveying : - Vol: I, Dr. K.R.Arrora,Standard Book House, Delhi-6.		

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2022-23 Year of Syllabus Revision: 2022-23	
B. E. Civil : Regular Program					
Year	I	SURVEYING-I			
Semester	II	Type of Subject Core / Elective / Foundation		Subject Code : CVL 1210LCS	
Mode of Transaction		Termwork: 02		Credit /Hours per week: 01/02	
Course Outcome (CO)					
Unit No.	Topic/Unit				
1	Theodolite Introduction				
2	Measurement of angles				
3	Lineout of building by manual method				
4	Lineout of building by Instrument (Theodolite)				
5	Road Profile survey				
6	Road profile sheet preparation				
7	Digital planimeter				
8	Introduction Total station				
9	Station set up, Angle measurement, Height measurement with Total station, Traverse survey with Total station				

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 1984 Year of Syllabus Revision: 2010, 2022	
B. E. Civil : Regular Program					
Year	I	APPLIED MECHANICS			
Semester	II	Type of Subject Core / Elective/ Foundation		Subject Code : APM 1206CS	
Mode of Transaction		Lectures: 04 Tutorial: 01		Credit /Hours per week: 04/04	
Course Outcome (CO) CO1 Understand various types of forces, force systems and equilibrium conditions CO2 Analyze the response of beams and trusses subjected to loading and Evaluate Center of Gravity and Moment of Inertia of any type of the section of the body, understand the concept of friction, machines CO3 Understand the properties and behavior of materials, understand the kinetics of rigid bodies, solve problems using force mass and acceleration method, work and energy method and impulse momentum method					
Unit No.	Topic/Unit				
1	Statics: Introduction, Forces and Force system Introduction to the subject of applied mechanics and its various branches. SI units. Coplanar, concurrent and non-concurrent force systems. Resultant and Resolutions, Forces in space. Vectors. Operations on forces using vectors. Moment of force, Varignon's theorem, Couple and its properties, Resultant of a coplanar force system. Concentrated and uniform loads. Resultant of a spatial force system. Wrench resultant, Equilibrium of a particle. External & internal forces, Equilibrium of rigid Body, Types of supports. Structural members and beams. Reactions of beams, Determinateness. Connected bodies. Two force and three force members. Trusses, Method of joints. Method of sections. Determinateness of truss. Rigid and non-rigid frames. Simple mechanisms. Space frames.				
2	Statics Center of Gravity, Moment of Inertia and Friction: Centre of gravity. Centroids of lines and of basic and composite areas, Built-up sections, Product of inertias. Mass moment of inertia, Types of friction. Characteristics of dry friction. Equilibrium on rough inclined plane. The wedge-The screw-The screw Jack-general bearing, Axle friction, Thrust bearing-Disc friction-Clutches.				
3	Statics: Transmission of power Lifting Machine, Basic machines, The differential principle, Linearlaw, Belt drive, Velocity ratio. Compound belt drive-length of belt. Transmission of power, Gearings, Trains of wheels. Epicyclic gearing. Speed reduction gear. Differential types of gear.				
4	Dynamics: Strength and Elasticity of Materials Review of kinematics of a particle. Force, mass and acceleration, Rectilinear and curvilinear motion. D'Alembert's principle, work, power and energy, Impulse and momentum, Equations of motion. Translation. Fixed axis rotation. Problems Involving friction, Simple stresses and strains. Hook's law. Elastic limit. Ultimate stress. Factor of safety, Lateral strain. Poisson's ratio. Stress concentration idea. Temperature stress. Simple shear, Elastic moduli relations.				
Reference Books					
1.	Applied Mechanics by S. B. Junnarkar and H. J. Shah, Charotar Pub.				
2.	Engineering Mechanics by Merum and Kraige, John Wiley & Sons.				
3.	Vector Mechanics by Beer and E. R. Johnstons, McGraw-Hill Book Co.				
4.	Engineering Mechanics by Huges and Martin, E.L.B.S. and Macmillan.				
5.	Engineering Mechanics by R. S. Kumar.				

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 1984 Year of Syllabus Revision: 2010, 2022	
B. E. Civil : Regular Program					
Year	I	APPLIED MECHANICS			
Semester	II	Type of Subject Core / Elective / Foundation		Subject Code : APM 1206LCS	
Mode of Transaction		Laboratory Experiments, <i>Assignments</i> , discussion and viva		Credit /Hours per week: 01/02	
Unit No.	Experiment				
1	Law of polygon				
2	Simple beam				
3	Jib crane				
4	Theory of lifting machine				
5	Rope and pulley block				
6	Screw jack				
7	Differential axle				
8	Worm and worm wheel				
9	Moment of inertia of fly wheel				
10	Radius of gyration of compound pendulum				
	Assignments				

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B. E. Civil : Regular Program					
Year	I	FUNDAMENTALS OF MECHANICAL ENGINEERING - CVL			
Semester	II	Type of Subject Core / Elective / Foundation		Subject Code : MEC 1213CS	
Mode of Transaction		Lectures: 04		Credit /Hours per week: 04/04	
Course Outcome (CO) CO1 Understanding of properties of gas CO2 Understanding of properties of steam . CO3 Understand of basics of boiler and steam engine. CO4 Understand basic of IC engine its thermodynamic cycles. CO5 Understand air compressors. CO6 Understanding of working cycles of refrigeration and air conditioning system. CO7 Understanding of coupling , clutch and breaks. CO8 Understand basic of power transmission system.					
	Topic/Unit				
1	Properties of gases: Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between Cp and Cv, Various non flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process				
2	Properties of steam: steam formation, dryness fraction, Boilers: Main types, constructional features and working, Boiler mountings and accessories, steam engines, determination of HP, BHP, FHP and mechanical and thermal efficiencies.				
3	Heat Engines: Heat Engine cycle, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles, Classification of I.C.Engines, Otto, Diesel and dual combustion engines, 2-stroke and 4-stroke engines, IHP, BHP, mechanical and thermal efficiencies.				
4	Air Compressors: Types and operation of Reciprocating and Rotary air compressors. Refrigeration & Air Conditioning: Refrigerant, Vapor compression refrigeration system, vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners.				
5	Couplings, Clutches and Brakes: Construction and applications of Couplings, Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc)				
6	Transmission of Motion and Power: Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive.				
Reference Books					
1.	Element of Mechanical Engineering by Desai and Sony, Atul Publication				
2.	Elements of Mechanical Enginerring, by Sadhu Singh, S. chand Publication.				
3.	Internal Combustion Engine by Mathur and Sharma				
4.	Rattan, S. S., ‘Theory of Machines’, Tata McGraw Hill				

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B. E. Civil : Regular Program			
Year	I	APPLIED MATHEMATICS–II-CVL	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : AMT1212CS
Mode of Transaction		Lectures: 02 Tutorial: 01	Credit /Hours per week: 03/03
Course Outcome (CO) CO1 Understand and apply the concept of multivariable functions , its differentiability concept and applications of partial derivatives in various engineering problems. CO2 Able to focus on understanding and applications of gradient, curl and divergence in engineering problems. CO3 Apply the concept of surfaces and level curves in solid geometry which helps in solving various application of engineering. CO4 Understand and implement the methods of curve tracing in two – dimensional space. CO5 Implement various concepts of matrices in engineering problems and able to solve system of linear equations using matrices. CO6 Make use of Fourier series to analyze wave forms of periodic functions arising in engineering. CO7 Classify partial differential equations and solution of Initial Boundary Value Problems.			
Unit No.	Topic/Unit		
1	Partial Differentiation and Analytical Geometry: Function of two variables – Definition of partial derivatives, higher order partial derivatives, differentiation of composite function and chain rule, Applications of partial derivatives (maxima and minima &Lagrange’s multiplier’s method) Reorientation of solid geometry, Surfaces and Conicoids, Curve tracing: Cardioid, Lemniscates, Spiral		
2	Vector Calculus: Reorientation, scalar and vector fields gradient of a scalar function, Directional derivative divergence and curl of a vector field and their applications		
3	Fourier Series Partial Differential Equations: Fourier Series of 2L periodic function, Even and Odd periodic function, Half Range expansions. Formation of first order partial differential equations, Solution of first order partial differential equations using Lagrange’s Method, Classifications of second order partial differential equations, Mathematical modeling of one-dimensional wave and heat equation, Solution of one-dimensional wave and heat equation using method of separation of variables,		
4	Matrices: Reorientation of Matrices, Rank of a matrix, solution of homogeneous and non – homogeneous systems of linear equations, Eigen values and Eigen vectors of a matrix.		
Reference Books			
1.	Erwin Kreyszig: Advanced Engineering Mathematics, (6th edition) John-Wiley & Sons.		
2.	Srivastava, Dhavan : Text Book of Engineering Mathematics, Dhanpat Rai & Sons.		
3.	Shantinarayan : Differential Calculus, S. Chand & Co. New Delhi.		
4.	Willfred Kaplan : Advanced Calculus, Addison Weseley Publ. Company, Inc.		
5.	C. R. Wylie : Advanced Engineering Mathematics, Mc. Graw – Hill, Inc.		

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B. E. Civil : Regular Program			
Year	II	BUILDING DRAWING AND DESIGN-CVL	
Semester	I	Type of Subject Core / Elective/ Foundation	Subject Code : CVL 1306CS
Mode of Transaction		Lectures: 03, Tutorials: 01	Credit /Hours per week: 04/04
Course Outcome (CO)			
CO1 Understand building bye laws and national building code for buildings.			
CO2 Understand and apply the principles of composition and planning for buildings.			
CO3 Understand acts, objectives and principles of town planning.			
CO4 Classify the types of sun-shading devices with their applications and design.			
CO5 Understand the growth of Indian town, slum improvement techniques.			
CO6 Draw and design the plan, elevation and section for various types of buildings.			
Unit No.	Topic/Unit		
1.	Introduction of municipal by-laws: Development Control Regulation (DCR) guideline includes Site plan, Layout, key plan, Floor Space Index, Building height, margins, Permissible built up area, set back, etc.		
2.	Introduction to basic principles of planning, orientation, aspect, prospect, furniture requirements, roominess, grouping, circulation, privacy, climate, economy, sanitation considerations etc.		
3.	Preparation of drawing based on plan: Complete drawing along with site plan, elevation, section. Working drawing set. Staircase, design of Dog-legged staircase,		
4.	Introduction to AutoCAD software, Different commands and their functions. Drawing using AutoCAD software.		
5.	Town Planning: Acts, Objectives. Principles: Provision of Road Layout, Green Belt, Recreation centre, housing, all Types of buildings, transportation facilities, Zoning. Classifications and growth of towns, natural and planned towns.		
6.	Slum: definition, causes, effects, precautions and improvement schemes.		
7.	Public Building: Types, planning criterias of various types of public buildings, design of public buildings, principles of composition.		
8.	Design of sun shading system, Overhang, louvers, Application of solar data to design louver system.		
Reference Books			
1.	Building drawing and detailing :Dr.Balgopal, T.S. Prabhu and Dr.K.VincentPoul,		
2.	Building planning and services (part-I) A.D.Joshi, Mrs. M.A.Joshi Publishers.		
3.	Civil Engineering drawing – R.J.Malik, G.S.Med, New Asian Pub. Delhi-6.		
4.	Planning and designing buildings – Y.S.Sane,		
5.	Building Drawing – M.G. Shah, C.M.Kale and S.Y.Patki		
6.	National building code- I.S.Publisher		
7.	Indian Standard 962 and 2332 I.S.Publisher.		

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B. E. Civil : Regular Program					
Year	II	BUILDING DRAWING AND DESIGN-CVL			
Semester	I	Type of Subject Core / Elective / Foundation		Subject Code : CVL 1306LCS	
Mode of Transaction		Drawing, Term work and viva		Credit /Hours per week: 01/02	
Unit No.	Topic/Unit				
1.	One Drawing sheet of residential building				
2.	Measured Drawing of Existing Building				
3.	Planning and Design of Residential building				
4.	Design of Public Buildings				

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B. E. Civil : Regular Program			
Year	II	MECHANICS OF MATERIALS-CVL	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : APM 1309CS
Mode of Transaction		Lectures: 04	Credit /Hours per week: 04/04
Course Outcome (CO) CO1: Determine the material properties, shear force, bending moment, slope and deflection in beam and apply for further analysis and design of structures. CO2: Calculate the shear stress and bending stress in different cross section of beams. CO3: Determine the Principal stresses and strains analytically and graphically and analyze and design thin shells and bolted connections. CO4: Apply strain energy concept to determine stress due to gradual, sudden and Impact loading. CO5: Analyze column under axial and eccentric load and determine direct and bending stresses in chimney, dam and retaining wall. CO6: Analyze the circular shaft under pure torsion as well as combined bending and torsion along with its application for the analysis and design of helical spring.			
Unit No.	Topic/Unit		
1.	Shear force, Bending Moment Diagrams, Stresses and Deflection in Beam : Shear Force, Bending Moment Diagrams :Diagram of bending moment and shearing force in cantilever and simply supported beams under static loads-analytically with varying, distributed loads and couples and verifying solutions to problems in open source applications. Stresses in beams : Theory of simple bending: Distribution of normal stress due to bending, moment of resistance, beam of uniform strength, flitched beam, built up section under bending, practical exposure to safe and economic beam section for residential and public buildings. Distribution of shear stress across various cross sections. Deflection in Beam : Curvature, slope and deflection of cantilever and simply supported beams including overhang beams by Macaulay's Method, permissible limits as per codal provisions, Carriage springs		
2.	Principal Stresses and Strains, Strain Energy, Connections and shells Principal Stresses and Strains: Ellipse and circle of stresses, Principal planes, Principal stresses and strains, Mohr's stress and strain circle for various applications of compound stress and verifying solutions of problems in open-source applications. Strain Energy: Resilience of sudden, impact and shock loading, Connections: Bolted joints, types of failure and load transfer in bolted joint, design of bolted connections as per codal provisions. Thin Cylindrical and Spherical Shells: Stresses in thin cylinders subjected to internal pressure, cylindrical shell with hemispherical ends, spherical shell, safety and economic aspects of pressure vessel in the industry.		
3.	Columns subjected to axial and eccentric loading Simple strut theory - Euler's and Rankine's Formula. eccentric loading on column for direct and bending stress combinations, Tension or compression combined with bending, hollow column for economical aspect and use of green engineered material in column. Middle third rule, Wind pressure on walls and chimney, water pressure on dam.		
4.	Torsion of Circular shaft Torsion of circular shafts of uniform sections. Torsional resilience. Distribution of torsional stress- Angle of twist, Power transmissions, combined bending and torsion including theories of failure, economic aspect of shaft, helical spring under axial force.		
Reference Books			
1.	Mechanics of Structures Vol. I by S.B. Junnarkar and H. J. Shah.		
2.	Introduction to Mechanics of Solids by I.P. Kapila and S.N. Agnihotri.		
3.	Elementary Strength of Materials by S. Timonshenko.		
4.	Strength of Materials by Ramamrutham.		
5.	Strength of Materials by R.C. Patel , T.D. Bhagia, & B.M. Patel.		

 THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2023-24 Year of Syllabus Revision: 2023-24
B. E. Civil : Regular Program			
Year	II	MECHANICS OF MATERIALS LAB-CVL	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : APM 1309LCS
Mode of Transaction		Laboratory Experiments, Discussion and Viva: 02	Credit /Hours per week: 01/02
Unit No.	Topic/Unit		
1.	Copmlete tensile test on mild steel (ms)		
2.	Modulus of elasticity for ms		
3.	Direct shear test on ms		
4.	Copmression test on ms and cast iron (ci)		
5.	Compression test on timber		
6.	Izod impact test on ci, ms and brass		
7.	Hardness test on ms, ci and brass		
8.	Torsion test on ms and ci		
9.	Modulus of rupture of timber		
10.	Modulus of elsticity of timber		
11.	Tutorials		

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B. E. Civil : Regular Program			
Year	II	ELECTRICAL ENGINEERING FUNDAMENTALS-CVL	
Semester	I	Type of Subject Core / Elective/ Foundation	Subject Code : ELE 1320CS
Mode of Transaction		Lectures: 04	Credit /Hours per week: 04/04
Course Outcome (CO)			
CO1 Explain the concept of DC Circuits, Electromagnetism and DC Machines.			
CO2 Determine the parameters of DC Circuits, Electromagnetism and DC Machines.			
CO3 Interpret the concepts of Electrical Power Sources.			
CO4 Explain the concepts of AC Circuits and AC Machines.			
CO5 Evaluate the AC Circuits and AC Machines.			
CO6 Relate the applications of Electrical Devices			
Unit No.	Topic/Unit		
1.	Fundamental concepts of DC circuits, analysis of series, parallel and series-parallel circuits with DC excitations, fundamentals of magnetic circuits and electromagnetic induction		
2.	Fundamentals of AC circuits, analysis of single-phase ac circuits consisting of R, L, C and their combinations, analysis of polyphase circuits.		
3.	Working principle of DC machine as a generator and a motor; types and constructional features, characteristics of DC machines, speed control and applications.		
4.	Principle of operation and simple construction of single phase transformers, EMF equation, losses and efficiency, autotransformer. Types, construction, working principle and applications of induction motor and synchronous machine.		
5.	Overview of renewable and non-renewable power sources, concept of cogeneration, and distributed generation; overview of transmission and distribution of power.		
6.	Application of electrical devices like components of LT Switchgear, types of wires, cables, earthing, measuring instruments, batteries, elementary calculations for energy consumption.		
Reference Books			
1.	A Textbook of Electrical Technology: Volume I,- B.L.Theraja & A.K.Theraja, S. Chand.		
2.	Problems in Electrical Engineering- Parker Smith, 9 th edition		
3.	Basic Electrical Engineering – V.N. Mittle, 5 th Edition, McGraw Hill		
4.	Basic Electrical Engineering – D.P. Kothari and I.J. Nagrath, 3 rd edition 2010, Tata McGraw Hill.		
5.	Basic Electrical Engineering – D.C. Kulshreshtha, 2009, Tata McGraw Hill.		
6.	Fundamentals of Electrical Engineering, L.S. Bobrow, Oxford University Press, 2011		
7.	Electrical and Electronics Technology, E. Hughes, 10 th Edition, Pearson, 2010		
8.	Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India.		
9.	Electrical and Electronics Measurement and Instruments by A K Sawhney		

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2023-24 Year of Syllabus Revision: 2023-24	
B. E. Civil : Regular Program				
Year	II	ELECTRICAL ENGINEERING FUNDAMENTALS		
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : ELE1320LCS	
Mode of Transaction		Laboratory: 02	Credit /Hours per week: 01/02	
Unit No.	Topic/Unit			
1.	Study of Laboratory apparatus and D.C machine.			
2.	Verification of Kirchhoff's laws.			
3.	R – L – C Series circuit.			
4.	Self and mutual inductance			
5.	AC parallel circuit.			
6.	Open circuit and short circuit test on 1-phase transformer			
7.	Power measurement in a 3-phase circuit by two wattmeter method			
8.	Speed control of DC shunt motor			
9.	Load Test on 3 phase induction motor			
10.	Study of Electrical Accessories, Wiring and Earthing			

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B. E. Civil : Regular Program					
Year	II	APPLIED MATHEMATICS – III-CVL			
Semester	I	Type of Subject Core / Elective / Foundation		Subject Code : AMT1312CS	
Mode of Transaction		Lectures: 02 Tutorial: 01		Credit /Hours per week: 03/03	
Course Outcome (CO) CO1 Understands the concept of different types of line integrals with evaluation techniques. CO2 Understands the Double, Triple integrations and can apply it appropriately, to evaluate Volume, Mass, Area CO3 Understands the relationships between various kinds of multiple integrals, line integral and apply these concepts in solving engineering problems. CO4 Develop skills to understand and implement complex valued functions to the potential theory and fluid flow problems. CO5 Understands the basic probability theories well and implement it to probability models with application to the areas related to Civil sector, and demonstrates a proficiency in collection, organization, design and drawing inferences from data using appropriate statistical methodology and problem solving skill. CO6 Able to analyze, classify and interpret data to answer questions about the real world problem, and able to demonstrate the ability to analyze data by appropriately fitting, assessing, and interpreting a various types of statistical models.					
Unit No.	Topic/Unit				
1.	Multiple Integrals: Reorientation of integrals, double and triple integrals- evaluation techniques, change of order of integration, Integrals in polar and cylindrical coordinates- transformation of multiple integrals, Applications of double and triple integrals for evaluation of Area, Volume and Mass. Vector Calculus: Line Integrals, Green’s theorem.				
2.	Functions of Complex Variables: Functions of a Complex Variable, Differentiability, C-R equations, Necessary and sufficient conditions of differentiability, Analytic function, Harmonic function, Conjugate harmonic function. Probability Theory: Reorientation of Probability, Random variables, Probability mass and density function, Probability distribution, Binomial, Poisson and Normal distributions.				
3.	Applied Statistics: Reorientation of measure of Central tendency and measure of dispersions, Correlation analysis, Regression analysis, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Confidence interval and Hypothesis Testing: Sampling Techniques, Central limit theorem, Construction of confidence intervals for population mean, Testing of hypothesis for single mean, difference of means for large samples.				
Reference Books					
1.	Erwin Kreyszig: Advanced Engineering Mathematics, John-Wiley & Sons.				
2.	Willfred Kaplan : Advanced Calculus, Addison Weseley Publ. Company, Inc.				
3.	C. R. Wylie : Advanced Engineering Mathematics, Mc. Graw – Hill, Inc.				
4.	S. P. Gordon, F. S. Gordo: Contemporary Statistics- A Computer Approach, McGraw-Hill International.editions, 1994				
5.	S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics (Sultan Chand, New Delhi).				
6.	S.P. Gupta : Statistical Methods, S. Chand & Sons., 2021				

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2020-21 Year of Syllabus Revision: 2023-24
B. E. Civil : Regular Program			
Year	II	NUMERICAL METHODS AND COMPUTER APPLICATIONS	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : APM 1318CS
Mode of Transaction		Lectures: 03	Credit /Hours per week: 03/03
Course Outcome (CO) CO1 Apply Microsoft Excel in civil engineering CO2 Create computer programs, flow charting etc., preparing computer programs for solving general and civil engineering problems. Develop programs for decision making and repetitive calculations. CO3 Create programs based on 1D and 2D arrays CO4 Evaluate problems based upon Initial value problems using numerical techniques CO5 Evaluate problems related to algebraic and transcendental equations using numerical methods CO6 Evaluate problems related to numerical integration using numerical techniques			
Unit No.	Topic/Unit		
1.	Elements of programming: Languages of Computer and Flowcharting, Constants and variables. Formatted/unformatted Input/output Statements, Structured programming. Decision and loop Control Statements. Subscripted variables and implied looping.		
2.	Study of Spreadsheets: Introduction to spreadsheet package and its Applications in Civil Engineering.		
3.	Drafting: Introduction to drafting package and it's applications in 2D and 3D. Introduction to Building information modeling.		
4.	Numerical Methods: Initial value problems and methods of solutions such as Picard method, Euler's method and Runge-Kutta method, Numerical Integration and Differentiation. Finding roots of algebraic and transcendental equations. False position method. Civil engineering application of all above methods.		
Reference Books			
1.	Fundamentals of Computers – Rajaraman V., 3 rd Edition, Prentice Hall of India, New Delhi, 1999.		
2.	The C Programming Language – Ritchie, D. M. and Kernighan B. W., 2 nd Edition, Prentice Hall of India Pvt Ltd, 2008.		
3.	Computer Oriented Numerical Methods – Rajaraman V., Prentice-Hall India.		
4.	An Introduction to Excel for Civil Engineers: From Engineering Theory to Excel Practice - Gunthar Pangaribuan		

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2023-24 Year of Syllabus Revision: 2023-24
B. E. Civil : Regular Program			
Year	II	NUMERICAL METHODS AND COMPUTER APPLICATIONS-CVL	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : APM 1318LCS
Mode of Transaction		Tutorial: 02	Credit /Hours per week: 01/02
Unit No.	Topic/Unit		
1.	Matrices and Determinants		
2.	Introduction to Computer and MS Excel		
3.	Introduction to C-programming		
4.	Simple C programs		
5.	C- programs with control Statements		
6.	C- programs using Arrays		
7.	Initial value Problem-1		
8.	Initial value Problem-2		
9.	Roots of Non-Linear Equation		
10.	Numerical Integration		

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2023-24 Year of Syllabus Revision: 2023-24
B. E. Civil : Regular Program			
Year	II	SURVEYING- II	
Semester	II	Type of Subject Core / Elective/ Foundation	Subject Code : CVL 1409CS
Mode of Transaction		Lectures: 04	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Understand the geometry of Curves, types of curves, application of curve in real life. CO2 Understand the principles of astronomy. CO3 Identify different types of survey, basics of Geodetic survey. CO4 Photogrammetry Survey and introduction of GPS. CO5 Introduction of G.I.S and Remote sensing. Application in engineering projects			
Unit No.	Topic/Unit		
1.	Geometry of circular curves- degree of curve layout of curves by chain and tape – Rankine’s method of deflection- obstacles in layout and of circular curves - Theodolite method, Numerical.		
2.	Geometry of compound and reverse curves, -. Ideal transition curve- Cubic parabola and field layout- numerical based on the same. Layout of the same in field- vertical curves		
3.	Computation of levels for vertical curves – Transition curves-theory-superelevation- Length of the transition curve; Ideal transition curve- Cubic parabola and field layout- numerical based on the same.		
4.	Geodetic survey:- Triangulation and precise traversing, Principles, Classification, Measurement of angles- Satellite station. Base line measurement - Reconnaissance survey and planning of subsequent operations. Theory of errors applied in adjustment of angles-computation.		
5.	Photogrammetric Surveys and mapping. Aerial and terrestrial photogrammetry. Global Positioning System.		
6.	Astronomy- Latitude, Longitude- true bearing of a survey lines - Celestial sphere and coordinate system for locating a celestial object Z.P.S. triangle, Time -Sidereal and solar time- Equation of time- Greenwich and local time-Simple methods of determining latitude, longitude and true bearing of x line.		
7.	Remote Sensing: Introduction, Principles of Energy Interaction in atmosphere and Earth surface features. Image interpretation techniques, visual interpretation, Digital Image Processing.		
8.	Geographical Information System- Definition of GIS, Key components of GIS, Functions of GIS, Spatial data, Spatial Information System, Geospatial analysis, Integration of Remote Sensing and GIS, Applications in Civil Engineering.		
Reference Books			
1.	Surveying Vol-II by Kulkarni and Kanetkar		
2.	Surveying Vol-II and III by B.C.Punamia		
3.	Surveying Vol-II and III by K.R.Arora		
4.	Advanced Surveying by S.Gopi, R. Sathikumar, and Madhu		
5.	Advanced Surveying by Dr. R. B. Khasiya and A.T.Motiani		

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2023-24 Year of Syllabus Revision: 2023-24	
B. E. Civil : Regular Program					
Year	II	SURVEYING- II			
Semester	II	Type of Subject Core / Elective/ Foundation		Subject Code : CVL 1409LCS	
Mode of Transaction		Field Practical: 02		Credit /Hours per week: 01/01	
Course Outcome (CO) CO1 Understand the geometry of Curves, types of curves, application of curve in real life. CO2 Understand the principles of astronomy. CO3 Identify different types of survey, basics of Geodetic survey. CO4 Photogrammetry Survey and introduction of GPS. CO5 Introduction of G.I.S and Remote sensing. Application in engineering projects					
Unit No.	Topic/Unit				
1.	Curves using non instrumental and Instrumental method with Total station				
2.	Contour Survey with Total station				
3.	Astronomy				
4.	Demonstration of G.I.S and mapping				
5.	Photogrammetry				

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2023-24 Year of Syllabus Revision: 2023-24
B. E. Civil : Regular Program			
Year	II	CONSTRUCTION TECHNOLOGY	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : CVL1410CS
Mode of Transaction		Lectures: 04	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Understanding and learning of various aspects of Shallow foundations, deep foundations, cofferdam, and dewatering in foundation. CO2 Understand the practices and to suggest techniques for temporary structures and conceptual learning of form work. CO3 Apply the concepts, principles and functional requirements construction procedures related to various building components; special treatments for buildings, types of finishes etc for buildings construction activities. CO4 Enumerate and Describe various structures in brickwork and partition wall. CO5 Learning all aspects of appropriate mode of vertical movements, design of staircase and mechanical vertical circulation. CO6 Understanding and conceptual learning of various building services for construction activities.			
Unit No.	Topic/Unit		
1.	Foundations – Shallow foundations - Spread and combined footing –raft and grillage foundations Deep foundations - Pile Foundation : Introduction, Uses of Pile, foundation in black cotton soil, Caissons: Box Open, monolith, pneumatic caisson. Dewatering in foundations - Dewatering by open pumping, deep well system, artificial freezing , electrolysis.		
2.	Cofferdams - Terminology, Types: earth fill, rock fill, Timber Crib, Sheet pile, Double wall, cellular, movable cofferdam		
3.	Temporary Works Scaffolding-Types of Scaffolding, Brick layers Scaffolding, Double, Cantilever, Suspended, Steel Shoring-Types of Shoring, Inclined Shore, Horizontal, Dead Shore Underpinning-Pit method. Pile method, Chemical Consolidation Formwork- Requirement of Formwork, Economy in Formwork, Materials used in Formwork and sizes of Formwork, Types of Formwork for different structural members, Formwork for column and floors, Formwork for walls, RCC beams and stairs.		
4.	Building Components Floors-Introduction, essential requirements of a floor, types of ground floors, Timber floors, composite floors, upper floor- timber, jack arch floor, reinforced concrete floor, ribbed floor, pre cast concrete floor, Floorings-flooring components, Factors affecting selection of flooring material, types-Murum, Stone, brick, flag stone, mosaic tiled, cement concrete, IPS floor, granolithic, terrazzo, vitrified flooring marble, timber flooring, rubber, vinyl flooring, PVC etc. Roof and Roof covering - Introduction, requirements of good roof terminology, Types of roofs, Various material used in Roof covering: Thatch, Shingles, Tiles, A.C Sheets, G.I Sheets, False Ceiling Building finishes -Plastering, pointing, its purpose, various types, construction procedures, advantages and disadvantages, suitability of each. Painting - Terminology, Ingredients in Paint, Types of Paints, Defects in painting		
5.	Structure in Brickwork : Pier & Wall Footing, Cavity wall, Fire Place, Buttress, Corbels, Circular Brickwork, Reinforced Brickwork, Partition Wall, Retaining wall & breast wall, Window sill, Threshold Partitions : Types of Partition, Brick partition, Glass partition, Timber partition, Metal partitions		
6.	Vertical Circulation Stairs – Terminology, Characteristics of an Ideal Stair, Types of Stair and Staircase, staircase planning, Types of steps, elevators and escalators		
7.	Special Treatments Damp-proofing- Causes of dampness, effects, methods of damp – proofing, materials used for damp-proofing, DPC treatment, Water Proofing Termite proofing:- Types of termites, anti-termite treatment, site preparation, soil treatment, physical structural barriers, post-construction treatment Thermal insulation: Terminology, Techniques for thermal insulation of Building components, Thermal insulation materials. Fire protection :- Terminology, Fire load, building and structural elements grading, Fire proofing materials, Characteristics of common building material with respect to fire resistance, fire alarm systems, fire quenching equipments Acoustics : Definitions, Basics of sound and its behavior in enclosed areas, Sound measurement unit, Materials used for sound insulation, Defects in Sound insulation		
8.	Building Services Ventilation and Air conditioning: Terminology, Objectives and other aspects of ventilation and Air-conditioning Refuse disposal in high rise building : Collection, Storage and treatment at the source House Drainage: Terminology, Principles of house drainage system, Types of traps, pipes, System of plumbing, Sanitary fittings.		

Reference Books	
1.	Sushil Kumar “Building Construction”, Standard Publishers Distributors
2.	Sharma and Kaul, Building Construction
3.	B.C Punammia “Building Construction”, Laxmi Publisher
4.	Bindra and Arora, “Building Construction”, DhanpatRai& Sons, New Delhi
5.	S. C. Rangwala “Building Construction”, Charotar Publishing House Pvt. Limited
6.	Gurcharan Singh “Building Construction”, Standard Book House, Rajsons Publications Pvt. Lt

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B. E. Civil : Regular Program			
Year	II	CONCRETE TECHNOLOGY & ELEMENTARY RCC-CVL	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : APM 1415CS
Mode of Transaction		Lectures: 03	Credit /Hours per week: 03/03
Course Outcome (CO) CO1 Identify basic and supplementary ingredients of concrete by evaluating their physical and mechanical properties and complying requirements as per codal provisions. Incorporate pozzolanic materials and chemical admixtures to produce most economical and sustainable concrete. CO2 Evaluate properties of concrete in fresh state for qualitative performance and ethical practices. CO3 Determine compressive, tensile and shear strength by destructive testing and develop professional and ethical practices of evaluating structural performance with the help of non-destructive testing. CO4 Create the most economical and stronger concrete mix proportioning as per codal provisions, excel programming of mix proportioning and describe ethical practices of execution. CO5 Apply concept of research based advanced concrete practices in the field which are environment friendly, impacting societal needs and long lasting. CO6 Analyze the structure and understand basic concept of design, code of practice, and develop idea of designing complex problems.			
Unit No.	Topic/Unit		
1.	Cement Concrete and its Constituents Historic development, composition of concrete, manufacturing of Portland cement, chemical composition of portland cement, types of cement, testing on cement and its compliance with IS codes, introduction to aggregates, properties of aggregates, testing of aggregates and its compliance with IS codes, water, quality of water used in concrete. Introduction to accelerators, retarders, plasticizers, super plasticizers, environment friendly mineral admixtures like fly ash, silica fume, ground granulated blast furnace slag (GGBS), metakaolin and their effects on sustainability of concrete.		
2.	Fresh Concrete Definition of workability, factors affecting workability, measurement of workability, slump test, compacting factor test, ethical practices for mixing- transporting-placing-vibrating-curing of concrete, segregation, and bleeding of concrete,		
3.	Testing on Hardened Concrete Need for testing, BIS criteria for testing, compression test by cube and cylindrical specimens, effects of various factors affecting the test results, moisture content, height/diameter ratio, shape of specimen, rate of loading, size of specimen, comparison of strength of cubes and cylinders, flexure test, split tensile test by destructive testing. Introduction to non-destructive test methods in professional practice and ethics to quantify safe residual life of RC structures.		
4.	Mix Proportioning of Concrete Nominal mix proportioning with IS 456 methods, introduction to IS 10262 (latest version), examples on mix proportioning for standard grade concrete using mineral admixtures like fly ash, silica fume, GGBS, ethical practices on acceptance criteria for strength. Excel programming on mix proportioning.		
5.	Introduction to Advanced Concrete Technology Introduction to durability for sustainable and long-lasting structures, creep and shrinkage of concrete. Introduction to special types of concrete like high strength concrete, geo-polymer concrete, self-compacted concrete, self-healing concrete, fiber reinforced concrete, high performance concrete, light wight concrete with context to current research . Impacting societal needs by using environment friendly industrial by product materials.		
6.	Introduction to RCC Loads on Structures, codes of practice, structural grade concrete. Design theories, singly reinforced section, flanged beam. transformed section, limit state method, analyze the structure and design for singly reinforced beam, shear and development length. Concept of designing complex structures.		
Reference Books			
1.	Properties of Concrete by A. M. Neville, Pitman Publishing Co. London.		
2.	Concrete Technology by M. S. Shetty, S. Chand & Co., New Delhi.		
3.	Concrete Technology by R. S. Varshney, Oxford & IBH.		
4.	Reinforced Concrete by A. K. Jain, Nemchand Bros.		
5.	Reinforced Concrete by H. J. Shah, Charotar Pub.		

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B. E. Civil : Regular Program			
Year	II	CONCRETE TECHNOLOGY & ELEMENTARY RCC-CVL	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : APM 1415CS
Mode of Transaction		Practical : 02	Credit /Hours per week: 01/02
Unit No.	Topic/Unit		
1.	Fineness Test of Cement		
2.	Standard Consistency Test		
3.	Initial and Final Setting time		
4.	Compressive strength of cement		
5.	Soundness of cement		
6.	Bulk density of aggregates		
7.	Sieve Analysis		
8.	Bulking of sand		
9.	Slump Test and Compaction Factor Test		
10.	Compressive strength of concrete		
11.	Flexure and Tensile Strength of concrete		
12.	Seminar on special concrete and group discussion		

 महाराजा सायजीराव सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2023-24 Year of Syllabus Revision: 2023-24
B. E. Civil : Regular Program			
Year	II	APPLIED GEOLOGY AND GEOTECHNIQUES-CVL	
Semester	II	Type of Subject Core / Elective/ Foundation	Subject Code : APM1416CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Classify rock and identify structural features of rock, evaluate index properties and classify soil to know the behavior of soil. CO2 Apply the knowledge of permeability characteristics of soil and seepage analysis to solve flow related problems through soils. CO3 Apply the compaction techniques for preparation of various types of earth structures CO4 Analyze stress distribution in soil under the load and consolidation settlement analysis for the stability of structures CO5 Analyze and determine Shear strength characteristics of soil for future study of analysis and design of foundation, retaining structures, slope stability analysis, stability of cuts CO6 Analyze soil characteristics when mixed with waste material.			
Unit No.	Topic/Unit		
1.	Engineering Geology, Introduction & Index properties of Soil: Evolution of the Earth, Origin and classification of rocks, Weathering processes, Concept of dip and strike. Different types of folds, faults and their mechanism. Joints and their classification, Physical and Engineering properties of rocks, Origin & occurring of soil, Functional Relationships Physical and Index properties, Grain size distribution, Consistency of clays, Classification of soils, Numerical Examples		
2.	Permeability, Seepage & Compaction: Permeability, Darcy's law, factors affecting permeability, Flow nets and seepage, Numerical Examples Compaction of soils (Laboratory and Field compaction), factors affecting compaction, Effect of compaction on engineering properties of soil, Numerical Examples		
3.	Stress Distribution& Consolidation: Stress distribution below soil mass, Boussinesq equations, pressure bulb, contact pressure, New Marks influence charts Numerical Examples Consolidation of soil, Evaluation of consolidation parameters from consolidation test, computation of settlement, Numerical Examples		
4.	Shear Strength: Shear strength of soil, Mohr- Column failure criteria, types of shear tests with respect to drainage, Laboratory shear strength measurements, Numerical Examples, Effect of waste mixed soil on compressibility and shear strength characteristics.		
Reference Books			
1.	Soil Engineering Vol. I by Alam Singh, Asia Pub. House.		
2.	Soil Mechanics and Foundation Engineering by B.C.Punamia, Std.Pub.		
3.	Soil Behaviour by Lambe&Whitmann, Nostrand Co.		
4.	Soil Mechanics by Oza H. P., Charotar Pub		
5.	Basics and applied soil mechanics by A.S.Rao and Gopal Ranjan		
6.	Parbin Singh, Engineering and General Geology, S. K. Kataria& Sons 2010.		
7.	F. G. Bell, Engineering Geology Second Edition, Elsevier Ltd, 2007.		

 THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2023-24 Year of Syllabus Revision: 2023-24	
B. E. Civil : Regular Program				
Year	II	APPLIED GEOLOGY AND GEOTECHNIQUES-LAB-CVL		
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : APM1416LCS	
Mode of Transaction		Laboratory: 02	Credit /Hours per week: 01/02	
Unit No.	Topic/Unit			
1.	Water Content Test, Field Density by Core Cutter and Sand Replacement Method			
2.	Sieve Analysis, Consistency Limits			
3.	Standard Proctor Test			
4.	Permeability Test, Specific Gravity of Soils			
5.	Consolidation Test			
6.	Unconfined Compressive Strength Test			
7.	Direct Box Shear Test			
8.	Triaxial Test			
9.	Mini Project			

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B. E. Civil : Regular Program			
Year	II	HYDRAULIC ENGINEERING-CVL	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : CVL1412CS
Mode of Transaction		Lectures: 04	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Students become aware about properties and behavior of fluids, fluid pressure and measurement of pressure. CO2 Students are able to understand kinematics of fluid flow CO3 Students are able to understand dynamics of fluid flow and apply fundamental laws of fluid mechanics CO4 Students are able to understand basics of pipe flow CO5 Students are able to understand losses in pipe flow under different types of arrangements of pipenetwork CO6 Students are able to understand flow measurement and fundamentals of open channel flow.			
Unit No.	Topic/Unit		
1.	Introduction to Fluid Mechanics and its role in Engineering Fluids – definition and types. Fluid properties and types. Fluid properties and unit of measurements. Fluid pressure – hydrostatic pressure and distribution. Measurement of pressure – gauges and manometers.		
2.	Fluid flow - Continuum concept. Fluid particle and flow description. Types and classes of flow. Kinematics of flow – flow velocity. Description of flow field-streamlines, path line, streamline; streamline flow. Flow acceleration. Translation, rotation and deformation of fluid element. Circulation. Vorticity. Ir-rotational flow – velocity potential function, flow net. Equation of continuity. Fluid forces stress and strain. Equations of motion. Euler’s equation		
3.	Dynamics of flow : . One Dimensional flow, Equation of continuity. Bernoulli’s theorem and its modifications and applications. Impulse Momentum theorem, Kinetic energy correction factor.		
4.	Fluid flow (incompressible) through closed conduits : Laminar & turbulent flow – Reynold’s Experiment, Resistance to flow – Froude’s Experiment Laminar flow through pipes and between parallel plates, velocity distribution and loss of head. Turbulent flow through pipes. Friction factor for smooth and rough pipes.		
5.	Minor loss of head in flow through pipe at expansion, etc. energy gradient and Hydraulic gradient – siphon pipe flow through uniform pipe between two – reservoirs.		
6.	Flow measurements - Flow through orifice, hydraulic coefficients of discharge and velocity. Flow over notch and weir – Rectangular, Triangular, Cippoletti. Pipe flow measurements – Venturimeter, Orifice meter, Pitot tube. Velocity and discharge measurement in open channel, Weirs and Flumes, Current meters.		
7.	Open Channel Flow:- Types of channel, Elements of open channel flow. Classification of open channel flow, Steady uniform flow through open channel. Chezy's equation, Manning's equation, Bazin's-Kutter's equation. Determination of normal depth of flow. Factors affecting Manning’s Rugosity coefficient, Most economical sections. Specific energy, Critical flow.		
Reference Books			
1.	Dave R.M., Fluid Mechanics Part I		
2.	Jain A.K., Fluid Mechanics		
3.	Mody P.N. & Sheth S.M., Hydraulics & Fluid Mechanics, Standard Book House.		
4.	Ramamritham S., Hydraulics, Fluid Mechanics and fluid machines, Dhanpat Rai Publishing Company, New Delhi.		
5.	Bansal R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications.		
6.	Vallentine H.R., Applied Hydrodynamics		
7.	Streeter V.L., Fluid Machine		
8.	Garde R.J. & Mirajgaokar A.J., Engineering Fluid,		
9.	Garde R.J., Fluid Mechanics through Problems, New Age International Publishers.		

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B. E. Civil : Regular Program			
Year	II	HYDRAULIC ENGINEERING LAB-CVL	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : CVL 1412LCS
Mode of Transaction		Practical / Termwork including Viva	Credit /Hours per week: 01/02
Course Outcome (CO)			
CO1 Students become aware about properties and behavior of fluids, fluid pressure and measurement of pressure.			
CO2 Students are able to understand kinematics of fluid flow			
CO3 Students are able to understand dynamics of fluid flow and apply fundamental laws of fluid mechanics			
CO4 Students are able to understand basics of pipe flow			
CO5 Students are able to understand losses in pipe flow under different types of arrangements of pipenetwork			
CO6 Students are able to understand flow measurement and fundamentals of open channel flow.			
Unit No.	Experiment		
1.	Term-work / Field Practical shall be based on above syllabus		
2.	Verification Of Law Of Hydrostatic Pressure		
3.	Determination Of The Coefficient For A Circular Orifice		
4.	Calibration Of A "V" Notch		
5.	Experimental Proof Of Bernoulli's Theorem		
6.	Calibration Of Venturimeter		
7.	Verification Of Reynold's Number For Laminar-Turbulent Flow		
8.	Verification Of Relationship Between Energy Loss & Velocity And Determination Of Friction Factor For A Pipe		
9.	Currentmeter		
10.	Rugosity Coefficient		
11.	Pitot Tube		
12.	Orificemeter		

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B. E. Civil : Regular Program			
Year	II	UNIVERSAL HUMAN VALUES – II	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : FTE1401CS
Mode of Transaction		Lectures: 02 Tutorial: 01	Credit /Hours per week: 03/03
Course Outcome (CO) CO1: Understand and analyze the self, and surroundings i.e. family, society and nature CO2: Understand the responsibility in life and to handle problems with sustainable solutions while keeping human relationships and human nature in mind. CO3: Improvement in critical ability CO4: Improvement in commitment towards human values, human relationship and human society			
Unit No.	Topic/Unit		
1.	Introduction to Value Education		
2.	Harmony in the Human Being		
3.	Harmony in the Family and Society		
4.	Harmony in the Nature/Existence		
5.	Implications of the Holistic Understanding		
Reference Books			
1.	A foundation course in Human Values and Professional Ethics by R R Gaur, R. Ashthana and G P Bagaria, 2nd and 3rd Edition (2019 and 2023).		
2.	Universal Human Values and Professional Ethics by Dr. Saroj Kumar, Prof. Sheenu Nayyar, Thakur Publication Pvt Ltd, (2020)		
3.	Rediscovering India - by Dharampal		
4.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.		
5.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi		
6.	Slow is Beautiful - Cecile Andrews 7 Economy of Permanence - J C Kumarappa		
7.	Economy of Permanence - J C Kumarappa 8 9 10		
8.	Bharat Mein Angreji Raj – Pandit Sunderlal		
9.	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999		
10.	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi		
11.	India Wins Freedom - Maulana Abdul Kalam Azad		
12.	Vivekananda - Romain Rolland		
13.	Gandhi - Romain Rolland		
14.	Online Universal Human Values material of AICTE.		

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2024-25 Year of Syllabus Revision: 2024-25
B. E. Civil : Regular Program			
Year	III	THEORY OF STRUCTURES	
Semester	I	Type of Subject Core / Elective/ Foundation	Subject Code : APM1501CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Analyze statically indeterminate beams and frames by Moment distribution method. CO2 Evaluate deflections in determinate structures using Castigliano’s theorem and Unit load methods. CO3 Analyze portal frames subjected to lateral loads by approximate methods. CO4 Analyze beams by matrix method of analysis. CO5 Draw influence line diagrams for beams and trusses. CO6 Evaluate stresses in beams subjected to unsymmetrical bending.			
Unit No.	Topic/Unit		
1.	Analysis of statically indeterminate structures. Moment Distribution and Slope deflection method for continuous beams and portal frames with different boundary conditions. Portal frames with and without sway, Continuous beams with and without yielding of supports		
2.	Deflection in Statically determinate Structures.Castigliano’s first theorem for beams, trusses and cantilever bents Curved members with various shapes. Unit Load method for beams, trusses and portal frames		
3.	Analysis of Portal frames by using approximate methods under lateral loads. Cantilever method and Portal method. Building frames subjected to lateral wind and earthquake loadings.		
4.	Introduction to matrix methods of analysis. Introduction to force and displacement method of analysis. Stiffness system approach for continuous beams.		
5.	Influence line diagrams for beams and trusses. Introduction to Rolling loads, Influence line diagram for Reactions, shear force, axial force and bending moment for various types of statically determinate beams and trusses. Muller-Breslau's principle. Influence lines diagrams for propped cantilever beams.		
6.	Unsymmetrical bending. Calculation of maximum and minimum stresses in cross section of beams subjected to unsymmetrical bending.		
Reference Books			
1.	Mechanics of Structure, Vol. I and Vol. II by S.B. Junnarkar & H.J.Shah, Charotar Publishing House. Anand, Gujrat		
2.	Basic Structural Analysis by C.S. Reddy, Tata McGraw Hill Publications, New Delhi		
3.	Theory of structures by S Ramamrutham & R. Narayan. Dhanpat Ray & Sons, New Delhi		
4.	Matrix analysis of framed structures by Weaver and Gere, C.B.S. Publishers, New Delhi		
5.	Indeterminate structures by C. K. Wang. MçGrahill, Kokagusha.		

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B. E. Civil : Regular Program			
Year	III	THEORY OF STRUCTURES- TW,PR., VIVA	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : APM1501LCS
Mode of Transaction		Laboratory: 02	Credit /Hours per week: 01/02
Unit No.	Topic/Unit		
1.	Influence line diagram for Shear Force.		
2.	Influence line diagram for Bending moment		
3.	Influence line diagram for Deflection		
4.	Verification of Moment distribution method for Continuous beam.		
5.	Sway force in portal frame by using Moment distribution method.		
6.	Horizontal reaction for Portal frame by using Moment distribution method.		
7.	Verification of slope Deflection method for Continuous beam.		
8.	Horizontal reaction for portal frame by using Slope deflection method.		
9.	Determination of deflection in simply supported beams using unit load method		

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2024-25 Year of Syllabus Revision: 2024-25
B. E. Civil : Regular Program			
Year	III	GEOTECHNICAL ENGINEERING	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : APM1502CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 To learn methods of site investigation including sampling and field tests for soil/rock, CO2 To learn advance topics of shear strength, CO3 To analyse earth pressure for retaining structures and bracing in cuts with their stability checks CO4 To analyse and design earth slopes and cuts CO5 To carry out soil design of shallow foundation, retaining structures with structural design CO6 To carry out soil design of pile foundation			
Unit No.	Topic/Unit		
1.	Site investigation and advance topics of shear strength of soil Field Exploration, Sampler, Sample disturbance, Standard Penetration Test, Static cone penetration test, Plate load test, Pile load test, Shear strength of cohesive and cohesionless soils, stress path, Skempton’s pore pressure parameters		
2.	Earth Pressure Theories &Retaining Structures: Earth pressure, Active, At rest and passive earth pressure conditions, Rankine’s Earth pressure theories, Culmann’s Graphical method, Bracing in open cuts, Cantilever Sheet pile wall, anchor bulkheads, Design of Cantilever retaining wall		
3.	Shallow foundation Bearing capacity of soil, Terzaghi's theory, Factors affecting bearing capacity, settlement-consideration and computation. Effect of water-table. Soil design of Individual, combined footing, Rafts. Structural design of isolated and combined footing. Codal provisions		
4.	Pile Foundation and stability of slopes: Point bearing and friction piles, Carrying capacity of single pile in clay and sand. Pile group and group efficiency. Stability of Slopes, Factor of safety, method of slices, Taylor’s stability number, Various stability conditions in an earth dam and canals, codal provisions		
Reference Books			
1.	Joseph E. Bowles, Foundation Analysis and Design, 5th edition, 2001, McGraw Hill.		
2.	Shamsher Prakash et al, Analysis Design of foundation and Retaining Structures, 1979, Sarita Prakashan.		
3.	Fang and Winterkorn, Foundation Engineering, Handbook, 2010, Galgotia Book Source.		
4.	S. P. Brahama, Foundation Engineering,1985, Tata McGraw Hill.		
5.	B. Das, Principles of Foundation Engineering, 9th Edition, 2018, Cengage India Private Ltd.		

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2024-25 Year of Syllabus Revision: 2024-25
B. E. Civil : Regular Program			
Year	III	ESTIMATION AND COSTING	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : CVL1502CS
Mode of Transaction		Lectures: 04	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Students can able to learn about importance of Estimate for Civil Engineering construction work. CO2 Students can able to learn about the methods for Approximate Estimate for civil engineering works CO3 Students can able to learn about Detailed Estimate for Building and preparation of Rate analysis of various items of construction works. CO4 Students can able to learn about Estimate of R.C.C work and Steel fabrication work. CO5 Students can able to learn about Detailed Estimate for Public work CO6 Students can able to learn about Specification of Civil Engineering Construction work.			
Unit No.	Topic/Unit		
1.	Estimate Estimate definition, Cost and Value of property Use of Estimate. Types of Estimate based on Accuracy- Approximate and Detailed Types of Detailed Estimate based on purpose of work- Quantity estimate, Revised estimate, Supplementary estimate, Complete estimate, Annual Maintenance and Repair estimate, Renovation estimate, Essential quality of good estimator, Information required for preparation of estimate		
2.	Approximate Estimate of Civil Engineering Works Purpose of preparing Approximate estimate General Principle of Approximate methods of costing Construction Cost Index, Approximate methods of costing for various Civil Engineering Works- Building, Bridge, Retaining wall, Dam, Canal, Road , water supply and sanitary projects, Methods for Approximate estimate		
3.	Detailed Estimate of Building Purpose of preparing Detailed estimate Method for Taking out Quantity and Abstracting or Bill of Quantity, Standard modes and units of measurements for various items of construction work as per IS1200, Rules for deduction in Masonry work, Concrete, Plastering and Painting work as per IS:1200 Contingency charge, Work charged establishment Quantity survey, Spot items, Prime cost and Provisional sums, Provisional Quantities, Daywork Accompaniments of an Estimate Estimate of Buildings – Residential building, Multi story building		
4.	Estimate of RCC work and Steel fabrication work Column and column footing, Beam and Slab, Staircase, Retaining wall, Raft foundation, Water tank Estimate of Steel structures- Steel Roof truss, Steel Grillage foundation, Steel stair case		
5.	Detailed Estimate of Public work Water Supply and Sanitary work, Septic tank and Soak- pit, Culvert, Bridge, Road, Irrigation Canal work, Dam		
6.	Rate Analysis Purpose of Rate analysis, Factors affecting Rate analysis, Market Inventory survey for Material, Labour wage and Tools-Plants- Equipment, Task work of Labours, Schedule of Rate Preparation of Rate analysis for various civil engineering construction works		
7.	Specification Use and Importance of Specification, Types Of Specification – Brief and Detailed, Open, Restricted and Closed Specifications, Design of Specification, Important aspect of design of specification, Principles of Specification writing, Source of information for Specification Drafting Technical Specification for Earthwork, Brickwork, RCC, Plaster, Flooring		
Reference Books			
1	Elements of Estimating and Costing (Professional practice) -S.C.Rangwala Pub., Charotar Book stall.Anand, Gujarat.		

2	Estimating and costing – B.N.Dutta, Pub. : S.Dutta and Co.Lucknow.
3	Estimating and costing – S.P.Chandola and Vazirani, Pub. Khanna Pub.
4	Textbook of Estimating and costing (Civil Engg.) G.S.Birdie, Pub., DhanpatRaiPublishing company (P) Ltd., New Delhi.
5	Estimating, costing, specification and valuation in Civil Engg. M.ChakrabortiPub., M. Chakraborty 10th edition. Kolkata
6	Civil Engineering contracts and estimates – Patil (Pub. Orient Longman).
7	Fundamentals of Public works procedure and Account – K.N.Pandya – pub. P.R.Mehta.
8	Quantity Survey (Estimation & CE Work – PLBHasin (Pub. S.C.Chand& Co.)
9	Mode of Measurements of Civil Engineering Works – I.S.1200.

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B. E. Civil : Regular Program					
Year	III	ESTIMATION AND COSTING TW, PRACTICAL AND VIVA			
Semester	I	Type of Subject Core / Elective / Foundation		Subject Code : CVL1502LCS	
Mode of Transaction		Termwork: 02		Credit /Hours per week: 01/02	
Unit No.	Topic/Unit				
1.	Preparation of Approximate estimate for Civil Engg. Works				
2.	Estimate of Residential Building				
3.	Estimate of RCC Column Footing, Beam , Slab				
4.	Estimate of RCC Retaining wall, Water tank				
5.	Estimate of Septic tank and Soak pit				
6.	Estimate of Steel fabrication work- Roof truss.				
7.	Estimate of Road construction , Canal construction work				
8.	Drafting of Technical specification of various items of civil construction work				
9.	Preparation of Rate analysis of civil construction work				
10.	Preparation of Approximate estimate for Civil Engg. Works				

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B. E. Civil : Regular Program				
Year	III	ENGINEERING HYDROLOGY		
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : CVL 1505CS	
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04	
Course Outcome (CO)				
CO1 Describe the basic concepts of hydrological cycle and its various phases ,interaction between its components, various processes, and estimation of hydrological components: evaporation, infiltration, transpiration, ET etc. CO2 Ability to understand concept of precipitation, its measurements, Various methods of analysis of rainfall data for a basin, Developing the concept of economy and accuracy in estimating optimum number of raingauge stations, Statistical analysis of historical rainfall data through recurrence interval at the probable storage dam site CO3 Study the basic principles and movement of ground water, groundwater aquifers and their properties CO4 Understand the concept of runoff, factors affecting, estimation of runoff ,Stream flow measurements techniques and compute flood using various methods for the sustainable and safe design of hydraulic structures CO5 Understand concepts of hydrograph analysis for flood estimation and Safety, Unit hydrographs, S-curve hydrograph, Synthetic and instantaneous unit hydrographs Design of the reservoir capacity of the storage dam, Understand the concept and importance of estimation of missing data and consistency of the rainfall data for identifying the reasons of inconsistency				
Unit No.	Topic/Unit			
1.	Hydrologic cycle and Rain gauges Introduction Development in hydrology and its role in water resources projects, Hydrologic Cycle: Precipitation: Types and forms of precipitations, Rain gauge instruments - types and their installation, site selection, measurement techniques, rain gauge network, variability in precipitation, Water losses: evaporation, interception, evapotranspiration, Sea water intrusion, types of aquifers. etc.			
2.	Precipitation: Methods of computing average, Rainfall, Mean Annual Rainfall, Missing data, Recurrence interval and frequency of a storm, Mass curve of Inflows-Net reservoir capacity, Consistency of rainfall data			
3.	Hydrologic Abstractions: Interception Evaporation: Factor affecting, estimation of evaporation, preventive measures, transpiration, evapo-transpiration and its measurements, Infiltration: Factors affecting infiltration, Infiltration indices, measurement of infiltration, Infiltrimeters			
4.	Ground water hydrology Ground Water Importance, Origin. Occurrence, distribution of ground water,– Aquifers, Zones of underground water, types of Aquifers, flow of groundwater, Darcy’s law& validity, Specific Yield, Storage Coefficient, permeability, Transmissibility, Well hydraulics, steady radial flow to a well in confined and unconfined aquifers, Infiltration gallery, collector wells			
5.	Runoff : Factors affecting Runoff, Estimation of runoff, SCS CN method examples, Stream flow measurements techniques			
6.	Hydrograph Analysis: components of Hydrograph, base flow separation, Unit Hydrograph, Definition, assumptions, uses, and limitations, derivation of Unit Hydrograph, Complex storm Hydrograph			
7.	Hydrograph Analysis: Changing the duration of unit hydrograph, Bernard’s percentage distribution graph and uses			
8.	Flood Estimation: Design flood, probable maximum flood, Methods of Flood estimation, Flood frequency analysis, Flood estimation by hydrograph			
Reference Books				
1.	Engineering Hydrology- K Subramanya (Tata McGraw Hill Pub.)			
2.	Engineering Hydrology H.M. Raghunath(Wiley Eastern Pub.)			
3.	Engineering Hydrology Jayarami Reddy (Laxmi pub)			
4.	Ground Water Hydrology D.K.Todd (John Wiley and Sons)			
5.	Hydrology and water Resources Engineering S.K. Garg (Khanna Pub.)			
6.	A Text Book of Hydrology & Water Resources Engineering by R.K. Sharma, T.K.Sharma (Dhanpatrai Publication)			

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B. E. Civil : Regular Program			
Year	III	FUNDAMENTALS OF STRUCTURAL DYNAMICS	
Semester	I	Type of Subject Core/ Department Elective/ Institute Elective/ Foundation	Subject Code : APM1551DECS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO)			
CO1: Understand and Evaluate the response of structures under dynamic loads.			
CO2: Be Familiar with the concept of structural dynamics and the various terms associated with the same.			
CO3: Evaluate the natural frequency and the time period of structural systems.			
CO4: Categorize the structures as over damped or underdamped.			
CO5: Understand the behavior of structures under dynamic loads and apply mitigation measures for controlling the response.			
CO6: Apply the concepts to structures under dynamic loading.			
Unit No.	Topic/Unit		
1	General Concepts: Introduction to general concept. Introduction to Dynamic loads and their types. Lumped mass system, Degrees of freedom Damping		
2	Structural Response: Simple harmonic motion. Free and Forced vibrations and it's effect on structures. Concept of resonance. Natural frequency and frequency of dynamic loads. Forced harmonic response. Concept of dynamic magnification factor and response of structures under vibrations.		
3	Single Degree of Freedom Structures: Equation of motion for SDOF systems. Over damped, critically damped and under damped systems. Logarithmic decrement. Evaluation of natural frequency and time period of SDOF systems. Modelling of SDOF system.		
4	Vibration control: The concept of active and passive control of structural vibrations under dynamic loads. Dampers and base isolators. Dynamic effect of earthquake loads on structures.		
Reference Books			
1.	Dynamics of Framed Structures - G.L.Rogers, John Wiley, 1959.		
2.	Structural Dynamics - J. M. Biggs, McGraw Hill Book Co. 1964.		
3.	Structural Dynamics – Theory and Computation by Mario Paz (2nd Edition), CBS Publishers and Distributors, New Delhi, 2001.		
4.	Elements of Earthquake Engineering by Jai Krishna, A. R. Chandrasekaran and B. Chandra, South Asian Publishers, New Delhi, 1994.		
5.	IS:1893-2002 “Criteria for Earthquake Resistant Design of Structures”, Bureau of Indian Standards, New Delhi, 2002.		

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B. E. Civil : Regular Program					
Year	III	ADVANCED CONCRETE TECHNOLOGY			
Semester	I	Type of Subject Core/ Department Elective/ Institute Elective/ Foundation	Subject Code : APM1552DECS		
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04		
Course Outcome (CO) CO1 Understand the chemistry of cement concrete and its constituents, properties of admixtures and dosages. CO2 Apply knowledge of various types of admixtures in production of different types of concrete. CO3 Evaluate effects on shrinkage and creep of concrete and modulus of elasticity of concrete. CO4 Evaluate durability aspects of concrete by understanding different transport mechanisms. Determine strength and quality of concrete with the help of NDTs. CO5 Design the mix proportioning of the regular and special concrete development in the field of concrete technology. CO6 Envisage latest development in the field of concrete technology.					
Unit No.	Topic/Unit				
1	Cement and Concrete Chemistry and Admixtures Hydration of Cements, structure of hydrated cement and Micro- structural development, mechanical strength of cement gel, bogue’s compound, influence of the compound composition on properties of cement, categorization of cementitious materials, accelerating admixtures, retarding admixtures, water reducing admixtures, nature, effects and dosage of superplasticizer, superplasticizer and cement compatibility, special admixtures: water proofing admixtures, anti-bacterial admixtures, fourth generation PCE based high performance concrete super plasticizer.				
2	Elasticity, Shrinkage and Creep of Concrete Elasticity of concrete, secant modulus and tangent modulus, dynamic modulus, shrinkage of concrete, autogenous shrinkage, drying shrinkage, factor influencing shrinkage of concrete, prediction of shrinkage, differential shrinkage, carbonation shrinkage, creep of concrete, factors influencing creep, relation between creep and time, nature of creep, effects of creep.				
3	Durability of Concrete Cause of inadequate durability, transport of fluids in concrete, diffusion, absorption, water permeability of concrete, carbonation, acid attack, sulphate attack, efflorescence, effect of sea water, alkali silica reaction, abrasion of concrete, erosion of concrete, cavitation, effect of freezing and thawing, chloride attack, laboratory tests to evaluate durability.				
4	Mix proportioning of Concrete Mixes and Non-destructive Testing Methods Mix proportioning of concrete, ACI and Indian Standard Method for proportioning of high strength, self-compacting and mass concrete, acceptance criteria for compressive and flexural strength, destructive and non-destructive tests for hardened concrete, recent development in concrete technology.				
Reference Books					
1	Properties of Concrete by A. M. Neville, Pitman Publishing Co. London.				
2	Concrete Technology by M.S.Shetty, S.Chand& Co., New Delhi.				
3	Concrete Technology by R.S.Varshney, Oxford& IBH.				
4	Reinforced Concrete by A. K. Jain, Nemchand Bros.				

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B. E. Civil : Regular Program					
Year	III	ADVANCED FOUNDATION ENGINEERING			
Semester	I	Type of Subject Core/ Department Elective/ Institute Elective/ Foundation		Subject Code : APM1553DECS	
Mode of Transaction		Lectures: 04		Credit /Hours per week: 04/04	
Course Outcome (CO) APM2104 CO1 Analyze Raft foundation CO2 Structural Design Raft foundation. CO3 Analysis of Laterally loaded piles CO4 Analysis and soil design aspects of well foundations CO5 Understand the concept of analysis and design of Piled-raft foundations CO6 Understand the concept of analysis and design of Machine foundations					
Unit No.	Topic/Unit				
1	Analysis and Design of Raft Foundation: Methods of analysis of raft- Rigid method, Simplified flexible method, General Flexible method, Contact Pressure distribution below raft, structural design of raft foundation.				
2	Laterally Loaded Pile Foundation and Piled-raft foundation: Matlock and Reese method, IS Code method and p-y curve method for analysis of laterally loaded vertical pile. Analysis of Piled- raft by poulos method.				
3	Well Foundation: Well components, shape and Grip length, Bearing capacity and Lateral stability of well.				
4	Machine Foundation: Terminology of Vibration, Free vibration, Force vibration, Analysis of SDOF, Types of Machines, Types of Machine Foundations, Design criteria, Design methods-Barken’s method, Determination of cu – Block vibration and cyclic Plate load test.				
Reference Books					
1.	Joseph E. Bowles, Foundation Analysis and Design, 5th edition, 2001, McGraw Hill.				
2.	Shamsher Prakash et al, Analysis Design of foundation and Retaining Structures, 1979, Sarita Prakashan.				
3.	Fang and Winterkorn, Foundation Engineering, Handbook, 2010, Galgotia Book Source.				
4.	S. P. Brahama, Foundation Engineering,1985, Tata McGraw Hill.				
5.	B. Das, Principles of Foundation Engineering, 9th Edition, 2018, Cengage India Private Ltd.				

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B. E. Civil : Regular Program			
Year	III	CONSTRUCTION AND ROAD SAFETY	
Semester	I	Type of Subject Core-/ Department Elective/ Institute Elective-/ Foundation	Subject Code : CVL1551DECS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Recognize the safety issues at different stages of construction activity, CO2 Understand the safety requirements in various construction operations. CO3 Understand the safety requirements in material handling and equipments to ensure safety at construction site. CO4 Understand concepts, principles, and tools of Road Safety as well as design parameters related to vehicular and pedestrian circulation. CO5 Develop fundamentals, significance and need for road geometric features and traffic control. CO6 Implementing road safety audit of existing road.			
Unit No.	Topic/Unit		
1	Introduction to Construction Industry- Need for Safety in Indian Construction Sites, Safety issues in construction- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry. Framing Contract conditions on safety, and related matters. Relevance of ergonomics in construction safety. Construction hazards and safety Construction hazards and safety guidelines; Prevention techniques for construction accidents; Site management with regard to safety recommendations; Training for safety awareness and implementation; Construction safety and health manual.		
2	Safety in various construction operations- Excavation and filling, under- water works, Scaffolds, Formwork,under- pinning & shoring, Tunnelling, Blasting- Demolition Work-Pneumatic caissons- confined Space Temporary Structures, Demolition and Contaminated Sites, Sewers and Confined Spaces, Indian Standards on construction safety- National Building Code Provisions on construction safety.		
3	Safety in material handling and equipments- Safety in storage & stacking of construction materials, Safety in use of construction equipments- Vehicles, excavators, graders, dozers, Cranes, Tower Cranes, Heavy Lifting ,Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Mixers,Conveyors, Pneumatic and hydraulic tools in construction. Temporary power supply, Fire Extinguishers, Fire Safety, Fire Prevention And Inspection Procedures , Fire Protection Law as/Bye Laws		
4	SAFETY Introduction to Road Safety Road as an active space, Types of Users, User Behaviour, Sensory Factors like Vision and Hearing in User Behaviour. Types of Vehicles: Heavy Vehicles, Light Motor Vehicle, Two Wheelers, Auto-Rickshaw, Bicycles and Cycle Rickshaw, Non-Motorised Vehicles. Vehicle Characteristics: Dimensions, Weight, Turning Radii, Braking Distance, Lighting System, Tyres, etc. Type of Hazards: Conflicts and Accidents. Need for Road Safety, Category of Road Users and Road Safety Suggestions. Precautions for Driving in Difficult Conditions (Night, Rain, Fog, Skidding Conditions, Non- Functional Traffic Lights, etc.). Types of Breakdowns and Mechanical Failures. Accident Sign (Warning Light, Warning Triangle, etc.). Introduction to Concept of Civic Sense and its relationship to Road Safety: Importance of Civic Sense, Road Etiquettes and Road User Behaviour, Rules of Road, Right of the Way. Providing Assistance to Accident Victim. Sensitisation against Road Rage. Road Accidents Nature and Types of Road Accidents (Grievously Injured, Slightly Injured, Minor Injury, Non-Injury, etc.) The situation of Road Accidents in India (Yearly), Fatality Rates, etc. factors (and Violations) that cause accidents, Prevention and First Aid to Victims Collision Diagrams and Condition Diagrams exercises. Traffic Management Measures and their influence in Accident Prevention.		
5	ROADS Roads, its Components & Design Road Classification: National Highways, State Highways, District Roads (MDR and ODR), Village Roads, Urban Road Classification: Expressways, Arterial, Sub-Arterial, Collector, Local, Service Roads, One-Way, Two-Way etc. Mountainous Roads. Speed Limits of the Road types. Design of Roads: Cross-Sectional Elements- Right of Way, Carriageway, Median, Shoulders, Sidewalk, Lanes, Cycling Track, Green Strip, Curbs, Camber, etc. Spatial Standards for the Cross- Section Design. Relationship between Road Design and Road Safety. Intersections Types of Road Intersections: Basic Forms of at-grade Junctions (T, Y, Staggered, Skewed, Cross, Scissors, Rotary, etc. Grade Separated Junctions (with or without interchange): Three-Leg, Four-Leg, Multi-Leg, etc. Design of Intersections: Design and Spatial Standards for Traffic Islands. Turns, Turning Radii, Directional Lanes, Pedestrian Crossings, Median Openings, Traffic Calming Components like Speed Breakers and Table-Top Crossings etc. Design Considerations for Diverging, Merging, and Weaving Traffic. Location and Design for Traffic Signals. Pedestrian Circulation & barrier free Design Requirement of Pedestrian Infrastructure: Sidewalks and Footpaths, Recommended Sidewalk Widths, Pedestrian Crossings, Pedestrian Bridges, Subways, Cycle Tracks, etc. Barrier		

	Free Design: Location and Design Standards for Ramps for Wheel Chair Access, Other Provisions
6	Road Safety Analysis Case studies based on IRC SP 88 manual for existing urban roads
No.	Tutorial
1	Tutorial on safety of materials handling and equipments in construction industry.
2	Tutorial on fire safety arrangements in High rise Building
3	Examples based on road geometry.
4	Solutions for different types of roads for traffic regulation and control for mid-blocks and intersections
5	Road safety audit based using IRC guidelines
Reference Books	
1.	Traffic Engineering and Transport Planning, LR Kadiyali
2.	Guideline for Road Markings, UTTIPEC Guideline and Specification for Crash Barriers, Pedestrian Railing and dividers, UTTIPEC Standard Typical Crossing Design
3.	IRC code of designs
4.	K.N.Vaid, Construction Safety Management.
5.	R.T. Ratay, Hand book of Temporary Structures in Construction.
6.	V.J. Davies and K.Tomasin, Construction Safety Handbook.
7.	James B.Fullman, Construction Safety, Security & Loss Prevention
8.	R.T. Ratay, Hand book of Temporary Structures in Construction.
9.	National Building Code of India
10.	Bhattacharjee, S.K. (2011) Safety Management in Construction
11.	Carl Goodson, “Essentials of fire fighting” Fire protection publications; 5th edition
12.	Indian Standards (Relevant) published by BIS

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B. E. Civil : Regular Program					
Year	III	CIRCULAR ECONOMY			
Semester	I	Type of Subject Core/ Department Elective/ Institute Elective/ Foundation		Subject Code : CVL1552DECS	
Mode of Transaction		Lectures: 03 Tutorial: 01		Credit /Hours per week: 04/04	
Course Outcome (CO)					
CO1 To understand basic concepts of sustainable development					
CO2 To understand the concept of circularity and conduct relevant research					
CO3 Apply the concept of circular economy to environmental engineering problems					
CO4 Use the principles of circularity for application to sustainable development					
CO5 Apply complexity aspects of circular economy for creating circular business models					
Unit No.	Topic/Unit				
1	Module I: Introduction to Circular Economy Linear Economy and its emergence, Economic and Ecological disadvantages of linear economy, Replacing Linear economy by Circular Economy, Development of Concept of Circular Economy, A differential - Linear Vs Circular Economy				
2	Module II: Characteristics of Circular Economy Material recovery, Waste Reduction, reducing negative externalities, Explaining Butterfly diagram, Concept of Loops				
3	Module III: Circular design, innovation and Assessment Zero waste: Waste Management in context of Circular Economy ,Circular design, Research and innovation, LCA, Circular Business Models				
4	Module IV: Case Studies Business models, Solid Waste Management / Wastewater, Plastics: A case study, EPR: polluters pay principle, Industrial symbiosis/ Eco- parks				
5	Module V: Legal and policy framework Role of governments and networks, Sharing best practices, Universal circular economy policy goals, India and CE strategy, ESG				
Reference Books					
1.	Walter R Stahel: The Circular Economy A User's Guide, Routledge; 1st Edition (24 June 2019)				
2.	Shalini Goyal Bhalla – Circular Economy: (Re) Emerging Movement, Invincible Publisher				
3.	Peter Lacy, Jessica Long, Wesley Spindler, The Circular Economy Handbook: Realizing The Circular Advantage, Palgrave Macmillan				
4.	Peter Lacy, Jakob Rutqvist - Waste to Wealth: The Circular Economy Advantage, Palgrave Macmillan				

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B. E. Civil : Regular Program					
Year	III	CLIMATE RESILIENT CITIES			
Semester	I	Type of Subject Core/ Department Elective/ Institute Elective/ Foundation		Subject Code : CVL1553DECS	
Mode of Transaction		Lectures: 03 Tutorial: 01		Credit /Hours per week: 04/04	
Course Outcome (CO) CO1 Understand Learn fundamentals of climate change and greenhouse gases CO2 Understanding climate change impact, vulnerability and risk assessment. CO3 Understanding climate change projections and national policies for climate change. CO4 Understanding how to develop IDF curves <u>CO5 Understanding Stormwater Management Module</u>					
Unit NO	Topic/Unit				
1.	The physical science of climate change Climate System; Causes of Climate Change.				
2.	Global atmospheric composition: Greenhouse gases and aerosols; Extreme weather events, sea level rise				
3	Climate impacts, vulnerability and risks, Assessing climate impacts on key sectors and systems				
4	Climate data and trends; Analyses of climate data				
5	Development of Intensity – Duration – Frequency curves, Assessment of carrying capacity of stormwater drains under climate change scenario				
5	Introduction to Stormwater Management Module for analysis and design of stormwater drains				
6	National policies for climate change (NAPCC, national missions).				
Reference Books					
1	IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Jochem Marotzke, Seita Emori, Ed Hawkins, Pie Forster, (eds).]				
2	IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)].				
3	IPCC, 2007: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds.				
4	IPCC, 2007: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)]				
5	IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Prepared by Working Group III of the Intergovernmental Panel on Climate Change [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow (eds)]				
6	Atmospheric Science, Second Edition: An Introductory Survey, John. M. Wallace & Peter V. Hobbs, Academic Press 2006				
7	Climate Change: From Science to Sustainability by Stephen Peake and Joe Smith, Oxford, 2nd ed., 2009				

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B. E. Civil : Regular Program					
Year	III	ADVANCED AND SUSTAINABLE CONSTRUCTION			
Semester	I	Type of Subject Core/ Department Elective/ Institute Elective/ Foundation		Subject Code : CVL1554DECS	
Mode of Transaction		Lectures: 03 Tutorial: 01		Credit /Hours per week: 04/04	
Course Outcome (CO)					
CO1 To learn all aspects of deep foundation in detail.					
CO2 To understand the concept of green buildings					
CO3 Develop skills for green building material practices and construction techniques for sustainability.					
CO4 Develop skills for green building planning.					
CO5 Acquire expertise of green building evaluation and certification from recognized agencies.					
Unit No.	Topic/Unit				
1	Deep foundation: Pile Foundation: Introduction, Uses of Pile, types of Piles with respect to load bearing and material, Pre-cast concrete pile, under reamed piles, Choice of types of pile, causes of pile failure, Caisson: Types of Caissons, sinking of caisson, floating of caisson, tilts and tilt correction in caisson, caisson sickness and preventive measures, Cofferdam; Types of Caissons, uses of coffer dam, prevention of leakage of water through coffer dam				
2	Basics of Green building: Overview of Green Building concept, Comparison : green building and conventional building, Necessity and requirements of green building, design principles, Major and minor aspects of green building, Scenario of green building adaptation at national and global platform, Advantages of green building construction.				
3	Green materials and Construction techniques: Concept of green material, identification and selection of green material, construction and demolition waste management and reuse, local material concept, Design strategies, internal load reduction, water and wastewater management, Rain water harvesting, Indoor Environment quality, A building Envelop, Introduction to intelligent energy management system, Ventilation, air conditioning and heating, Solar Energy system, IGBC/LEED standards.				
4	Green Building planning: Site preparation, Health and safety planning, Onsite construction waste management, Lighting and cleaning systems for green buildings ,IGBC/LEED standards for Green building planning and implementation, Project cost and Cost effectiveness, Case studies of residential, commercial and industrial buildings.				
5	Green building Evaluation Systems: IGBC/LEED Building Assessment Standard, The LEED Certification Process, Green building certification checklist, LEED Certification, The Green Globes Building Assessment Protocol, Green Globe Certification.				
Reference Books					
1.	B.C Punamia “Building Construction”, Laxmi Publisher				
2.	Bindra and Arora, “Building Construction”,DhanpatRai& Sons, New Delhi				
3	S. C. Rangwala “Building Construction”, Charotar Publishing House Pvt. Limited				
4	Sustainable building design manual: Sustainable building design practices, The Energy and Resources Institute, New Delhi, 2009.				
5	Jerry Yudelson, “Green Buildings A to Z”, Understanding the buildings, www. newsociety.com, 2008				
6	“Green building guidelines: Meeting the demand for low-energy, resource-efficient homes”, Sustainable Buildings Industry Council, 2004.				
7	T E Glavinich, Green Building Construction, Wiley, New Jersey, 2008.				
8	T Hasegawa, Environmentally sustainable buildings: challenges and policies, Organization for economic co-operation and development (OECD) publications, Paris, 2003.				

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		Year of Introduction: 2024-25 Year of Syllabus Revision: 2024-25
B. E. Civil : Regular Program			
Year	III	FUNDAMENTALS OF STRUCTURAL DESIGN	
Semester	II	Type of Subject Core / Department Elective / Institute Elective / Foundation	Subject Code : APM1610CS
Mode of Transaction		Lectures: 02 Tutorial: 01	Credit /Hours per week: 03/03
Course Outcome (CO) CO1 Design of Rc member for shear, development lengths, deflection and cracks CO2 Design of one way, two way and continuous slabs and stairs. CO3 Design of different types of beams. CO4 Apply methods of design of steel structure. CO5 Evaluate the properties of steel strcutureand design the connections for axially loaded members. CO6 Design axially loaded members and flextural members in steel structures.			
Unit No.	Topic/Unit		
1	Introduction to steel design and design of connections Advantages of steel structures - properties of structural steel - design methods –working stress and Limit state method Standard sections - IS codes of practice. Connections: Riveted, Bolted and welded connections for axial and eccentric loads, High strength friction grip bolts.		
2	Design of steel members by Limit state method. Tension members - net area - lug angle - tension splice. Compression members - slenderness ratio-permissible stresses - tacking rivets - design of simple columns. Design of Simple and compound beams – Introduction of Plate Girder. Lateral instability of compression flange - beam subjected to bending about two axes		
3	Reinforced concrete structures, design of slabs, and design of different type of stair cases. Practical Problems on simply supported one-way slab, two-way slab, Continuous one way and two way slabs, design of different types of stair cases.		
4	Reinforced concrete structures, design of beams, slabs, and design of different type of stair cases. Practical Problems on simply supported beams and cantilever beams, design for torsion. Design of Continuous beams, Redistribution of moments,		
Reference Books			
1.	Reinforced Concrete by H. J. Shah, Charotar Pub.		
2.	Reinforced Concrete by A. K. Jain, Nemchand Bros.		
3.	Design of Steel Structures by L. S. Negi.		
4.	Design of Steel Structures by Arya and Ajmani, Nemchand Bros.		
5.	Design of Steel structure by MacGinley		

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B. E. Civil : Regular Program				
Year	III	FUNDAMENTALS OF STRUCTURAL DESIGN TW, PRACTICAL & VIVA		
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : APM1610LCS	
Mode of Transaction		Tutorial: 02	Credit /Hours per week: 01/02	
Course Outcome (CO)				
Unit No.	Topic/Unit			
1	Design of small residential building for gravity load only.			
2	Design and drawing of footing			
3	Design and drawing of ground beam and plinth beam			
4	Design and drawing of lintel, loft and weather shed			
5	Design and drawing of ground floor slab			

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B. E. Civil : Regular Program			
Year	III	ENVIRONMENTAL ENGINEERING	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : CVL1609CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO)			
CO1 To estimate domestic water requirement and wastewater generation for a community			
CO2 To understand the concepts of quality of water and wastewater			
CO3 To learn the components of water distribution system and sewerage system with the design of water transmission and distribution system			
CO4 To understand engineering concepts of municipal solid waste management			
CO5 To understand control strategies for abatement of air and noise pollution			
Unit No.	Topic/Unit		
1	Water Requirement Per capita demand, recommendations for per capita demand, various types of water demand-domestic, institutional and industrial, public use. UFW- recommended values; Fire demand – types of system- fire hydrant and static tank, factors influencing water requirement, recommended values, Factors influencing per capita demand; Variations in water demand- Seasonal, monthly, daily and hourly variations, coincident draft, design flow for various components of water supply scheme- Numerical example; Design period, Factors governing length of design period, recommended values; Methods of population forecasting-suitable application of each method, numerical examples on population forecasting and water requirement; Water conservation in buildings- Use of water saving devices and fixtures, dual plumbing system Water quantity for public supply; Water quantity From Different Sources, Raw water intakes, Functions, site selection, types of intakes, design criteria, design Problems		
2	Quantity of Domestic Wastewater Quantity of Sanitary Sewage, Variation in Sewage Flow, Types of sewerage System		
3	Water Transmission Introduction to water transmission systems, hydraulics of transmission systems, methods to find head loss; Darcy-Weisbach (Coolbroke-White, Slitcher, Nickuradse, and Swamee-Jain equations for f), Manning’s, and Hazen-William’s equations for head loss; Pipe line systems (series, parallel, and branched) and examples; Structural requirements of transmission lines; Thrust blocks and design example; Pipe materials		
4	Water Distribution Distribution systems, basic requirements of capacity and pressure; house connections, distribution reservoirs; Network analysis by equivalent pipe method; Network analysis by Hardy-Cross method		
5	Development of Water supplies Surface Water supplies and Ground Water Supplies With qualities and quantity in general		
6	Water and Wastewater Qualities Water Qualities Criteria for Drinking purpose, Physical water quality parameters: Turbidity, color, Taste & odor, Temperature, Suspended solids; Chemical water quality parameters: pH, Hardness, Dissolve Gases, Fluoride, Chloride, Toxic Metals, Nitrates, Alkalinity, Acidity, Iron & Mangeses, Residual Chlorine & chlorine Demand, Types of chlorination; Bacteriological Qualities: Total count of Bacteria, M.P.N., Membrane Filter Technique. Wastewater Characteristics, Physical, Chemical & Bacteriological Characteristics, (B.O.D., C.O.D., Oil & Grease, Numerical Example on B.O.D.)		
7	Municipal Solid Waste: Classifications, Characteristics, Quantity Estimation, Collection, transportation and disposal methods		
8	Air Pollution: Definitions, Sources, effects, types and Classification of gaseous and particulate pollutants, Prevention and Control strategies. Noise Pollution: Introduction, Sources, Effects and Engineering Control measures.		
Reference Books			
1.	Metcalf & Eddy : Wastewater Engineering- Treatment and Reuse		
2.	M.N.Rao & H.V.N.Rao – ‘Air pollution’		
3.	G.S.Birdi, ‘Water supply and sanitary Engg.’		
4.	V.N.Gharpure “A Text book of Water supply Engg. Theory, design and practice.		
5.	Santosh kumar Garg, ‘Water Supply Engineering’		
6.	Santosh kumar Garg, ‘Wastewater Engineering’		
7.	CPHEEO Manual on water supply and treatment, Ministry of urban development, New Delhi.		
8.	CPHEEO Manual on sewerage and sewage treatment, Ministry of urban development, New Delhi		

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B. E. Civil : Regular Program				
Year	III	ENVIRONMENTAL ENGINEERING -TW, Pr & Viva		
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : CVL1609LCS	
Mode of Transaction		Laboratory: 02	Credit /Hours per week: 01/02	
Unit No.	Topic/Unit			
1	Drinking Water Standards			
2	Treated Waste Water Disposal Standards			
3	Determination of Total Solids			
4	Determination of Hardness			
5	Determination of Carbonate Hardnes			
6	Determination of Chlorine Demand			
7	Determination of Residual Chlorine			
8	Determination of Dissolved Oxygen (D.O)			
9	Determination of Biochemical Oxygen Demand (B.O.D)			
10	Determination of Chemical Oxygen Demand (C.O.D)			
11	Determination of Most Probable Number (MPN) of coliform organism			
12	Determination of pH			
13	Determination of Turbidity (N.T.U)			
14	Chemical Coagulation of Water			
15	Determination of Iron			
16	Determination of Fluoride			
17	Observation of Microorganisms			

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B. E. Civil : Regular Program			
Year	III	BASIC TRANSPORTATION SYSTEM	
Semester	II	Type of Subject Core / Elective / Foundation	Subject Code : CVL1614CS
Mode of Transaction		Lectures: 02 Tutorial: 01	Credit /Hours per week: 03/03
Course Outcome (CO)			
CO1 Apply engineering knowledge to understand railway track and its components, alignment, creep and station yards			
CO2 Design rail joints, track stresses, points and crossings, tractive resistances, Signaling and control			
CO3 Apply engineering knowledge to explain different types of bridge and its components			
CO4 Identify different parameters related to hydraulic aspect of bridge design and planning criteria for Docks and harbour			
CO5 Apply engineering principles for classification of docks and harbor and its components			
Unit No.	Topic/Unit		
1	Railway engineering Permanent Way Cross sectional elements, Types, Selection of Sleepers, Ballast, creep, alignment, Rails and Fixtures and Fastenings, Maintenance programs		
2	Railway points and crossing and turnout, their components and layout consideration, Railway Signalling and Control systems		
3	Railway Station Yards, Layouts and Equipments, Stresses in Track Structures Modernization of Railway Track		
4	Bridge engineering Bridge Engineering- Introduction, Structures, Functions of Components, Bearing for Bridge Structure, Classification criteria, Bridge Site selection criteria and investigation		
5	Hydraulic aspect of bridge design-Design parameters & approach, Examples based on theory		
6	Low-cost bridges, Types of bridge superstructure, Bridge substructures- pier, abutment and wing wall		
7	Harbour engineering Introduction, Classification of harbor & Port, Requirements of harbour, Site selection criteria, Principles of harbour planning Natural Phenomena-Wind, Wave, Silting, Erosion & Drift		
8	Types & characteristics of Marine Structures-Breakwater, Piers, Wharf, Quay, Jetty, Fender, Dolphin and Dock structures Navigational aids: Necessity, Types-Fixed and Floating		
No.	Tutorial		
1	Examples of sleeper density, ballast depth, rail type selection		
2	Tractive resistances		
3	Design calculations of turnout and cross-over		
4	Example of economic span, scour depth and afflux determination		
5	Design calculation for hydraulic aspect of bridge design		
6	Assignment: Harbour planning & Marine structures		
Reference Books			
1	“Railway Engineering” by Satish Chandra and M. M. Agarwal, Second Edition, Oxford University Press, 2022		
2.	“A text book of Railway Engineering” by S. C. Saxena and S. P. Arora, Publisher : Dhanpat Rai and Sons, New Delhi, 2016		
3	“Principles of Railway Engineering” by S. C. Rangwala, Publisher: Charator pub. House, 2015		
4	“Principles and Practice of Bridge Engineering.” by S.P. Bindra, Publisher: Dhanpatrai and sons		
5	“Essentials of Bridge Engineering.” by D Johnson Victor, Publisher: Oxford & IBHPub.Co., 2019		
6	“Bridge Engineering.” by S.Ponuswamy, Publisher: Tata Mcgraw Hill		
7	“Docks & Harbour Engineering.” by S. P. Bindra – Publisher: Dhanpat Rai and Sons		
8	“Harbour, Dock and Tunnel Engineering.” by R. Srinivasan, Publisher: Charotar Pub. house		
9	“Design and Construction of Ports & Marine structures” by Quinn A linzodef, Publisher: Mcgrawhill Co.		

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B. E. Civil : Regular Program			
Year	III	CONSTRUCTION PLANNING AND MANAGEMENT	
Semester	II	Type of Subject Core / Elective/ Foundation	Subject Code : CVL1615CS
Mode of Transaction		Lectures: 04	Credit /Hours per week: 04/04
Course Outcome (CO)			
CO1 Apply the planning for construction projects, Learn the various Planning methods Such as Network methods and Conventional method and developing Bar chart, Introduction of construction equipments			
CO2 Various Phases through which the construction project has to pass, Plan the Construction Project using Network Methods, Developing the CPM and PERT networks for Construction Project, CPM Method - Project completion time , critical path, Activity time duration			
CO3 PERT method of planning Analyze the schedule of the construction project, Event occurrence time, Critical path, Analyzing the probabilities of completing a project in a scheduled time duration			
CO4: Applying Time- Cost- optimization, Preparing revised schedule - Resource allocation, Controlling and Monitoring of the construction project - Updating of the project			
CO5 Understand and Learn the various types of Floats of the activities, Understand Engineering fundamentals related to construction equipment			
CO6 Construction equipments, selection, Working and Suitability, output, estimation of owning and operating cost.			
Unit No.	Topic/Unit		
1	Construction Planning: Necessity, Construction Project Planning Phases, methods of planning-comparisons Fundamental terms: events, activities, Time Estimates, Numbering the events and methods, Rules and Guidelines to develop network		
2	Critical Path Method: Developing a network, critical path, Scheduling Programme Evaluation and Review Technique (PERT) method: Developing a Network, Frequency and Probability Distribution of Time Duration, Construction scheduling Probability of Completing a project in a scheduled time duration		
3	Time Grid Diagrams, Time-Cost Optimization-Crashing		
4.	Resource allocation, Time- cost Optimization Construction Control – Updating		
5	Conventional method of Planning –Barchart Floats of the activities of the construction projectEngineering Fundamentals, Rolling Resistance, effect of grade Drawbar pull, Rimpull, acceleration, cycle time, swell and shrinkage of soils. Tractors and related equipments Tractors – types, performance gradability		
6	Bulldozers -types and output, Tractor, rippers, land cleaning equipment Excavating Equipment: Powershovel, Dragline, Back-hoe, Clamshell, Scrapers; types and out– types and size, selection, optimum depth of cut		
7	Hauling equipments: Trucks and wagons, types and capacities Compacting equipment; Rollers, their suitability for different operations.Belt conveyers component and power required. Other Construction equipments:pumping equipments, types of pumps used in construction work ,selections.Drilling and blasting of rocks, drill bits, selection of drilling patterns, rates of drilling use of compressed air compression in drilling. Concrete Mixers: Types and Size		
8	Selection of construction Equipment Methods of depreciation, Cost of owning and operation of equipment Cost of Maintenance and repairs of construction equipment.		
Reference Books			
1	Construction Planning, equipment and Methods – R.C.Peurifoy.		
2	Construction equipment, planning and applications :MeheshVerma		
3	PERT & CPM by Punamia and Khandelwal		
4	Critical path methods in construction practice – Antia		
5	Farm Machinery and equipment : Smith and Willes		
6	Farm Machinery :Gulfin.		

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B. E. Civil : Regular Program					
Year	III	CONSTRUCTION PLANNING AND MANAGEMENT: TW, Pr & Viva			
Semester	II	Type of Subject Core / Elective / Foundation		Subject Code : CVL1615LCS	
Mode of Transaction		Termwork: 02		Credit /Hours per week: 01/02	
No.	Termwork				
1	BAR CHART - ASSIGNMENT 1				
2	NETWORK ANALYSIS – ARROW DIAGRAM - ASSIGNMENT 2				
3	DEVELOPMENT OF NETWORK 3				
4	DETERMINING CRITICAL PATH AND PROJECT COMPLETION TIME – ASSIGNMENT 4				
5	FLOAT TIME CALCULATION - ASSIGNMENT 5				
6	TIME GRID DIAGRAM - ASSIGNMENT 6				
7	TIME COST OPTMIZATION - ASSIGNMENT 7				
8	RESOURCE ALLOCATION - ASSIGNMENT 8				
9	UPDATING - ASSIGNMENT 9				
10	PERT (Programme Evaluation Review Technique) - ASSIGNMENT 10				
11	PERT : TIME ESTIMATES - ASSIGNMENT 11				
12	VOLUMETRIC MEASURE - PROBLEMS - ASSIGNMENT 12				
13	TRACTORS & RELATED EQUIPMENT - ASSIGNMENT 13 Problems based on Bull Dozer & Ripper				
14	EXCAVATING EQUIPMENT - ASSIGNMENT 14 Problems power shovel, Drag line, Back hoe, Clam shell				
15	COMPACTING EQUIPMENT - ASSIGNMENT 15 Problems				
16	COST OF CONSTRUCTION EQUIPMENTS - ASSIGNMENT 16 Problems related to Owning and Operating cost				
17	PUMPING EQUIPMENTS - ASSIGNMENT 17 Problems				
18	Development of Bar chart for Construction project Using Microsoft Project - ASSIGNMENT 18				

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B. E. Civil : Regular Program				
Year	III	ELECTIVE-II TRANSPORTATION PLANNING		
Semester	II	Type of Subject Core / Departmental Elective / Institute Elective Foundation	Subject Code : CVL1651DECS	
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04	
Course Outcome (CO)				
CO1 Identify interdependence of land use and transportation while applying system approach to transportation planning CO2 Data generation by different transportation survey methods				
CO3 Apply four-step model for travel demand forecasting.				
CO4 Understanding of parameters considered in transportation planning along with application of some demographic analysis: Population forecasting models				
CO5 Determine benefits & Challenges of mass transit system at various level				
Unit No	Topic/Unit			
1	Regional Planning: Introduction to Transportation planning, Classification and delineation of regions			
2	Demographic analysis: Population forecasting methods: Population forecast, Linear, Exponential, modified exponential, comparative, ratio models and Gompertz curve model, Cohort – survival model, migration model			
3	Urban Transport Planning Process: Urban travel patterns - Study area delineation- Zoning - Planning surveys – Urban activity system- Sustainable urban transport - Systems approach, Travel Demand Estimate-Trip based and activity based approach - travel demand modeling, Data needs and outputs - Quick response techniques -Survey designs			
4	Trip Generation: Productions & Attractions - Influential factors –Trip rate analysis-Category analysis- Simple & Multiple linear regression models			
5	Trip Distribution: Interchange matrix – Growth factor methods, Synthetic methods –Calibration of Gravity model			
6	Modal Split: Influential factors – Diversion curves & surfaces, Discrete choice models, Concept, Types, Binomial Logit models and Multinomial Logit models			
7	Trip Assignment: Trip Assignment procedure – Diversion curves - All or Nothing assignment - Multipath assignment - Capacity restraint assignment – User equilibrium and system equilibrium approach			
8	Public Transportation and its Importance: Transit Terminology, Classification of transit modes, Transit capacity and level of service, Characteristics of public Transit System, Characteristics of selected mass transit system (BRTS)			
No.	Tutorial			
1	Examples based on four-step travel demand forecasting methods			
2	Field work on Household survey and road-side interview survey and analysis of data			
3	Examples based on population forecasting			
4	Examples related to public transit system			
Reference Books				
1	Traffic Engineering and Transport Planning by Dr. L R Kadiyali, 9 th edition, Khanna Publishers			
2	Urban Transportation System by Dr. P. J. Gundaliya and Dr. H. R. Varia, Mahajan Publishing House; 3 edition (2014)			
3	Transportation Planning: Principles, Practices and Policies by P.K. Sarkar, Vinay Maitri and G. J. Joshi, Pub. PHI			
4	Transportation Engineering and Planning, C. S. Papacostas and Panos Prevedouros, Pearson Education India; Third edition (31 July 2015)			

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B. E. Civil : Regular Program			
Year	III	GROUND WATER ENGINEERING	
Semester	II	Type of Subject Core / Departmental Elective / Institute Elective Foundation	Subject Code : CVL 1652DECS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Understand the groundwater aquifers and their properties CO2 Analyze the ground water flow processes. CO3 Prescribe the preventive measures for water quality and salt water intrusion. CO4 Design the Tubewells CO5 Select the pump for irrigation CO6 Suggest the strategies for management of groundwater.			
Unit No.	Topic/Unit		
1	Ground Water Occurrence: Importance, Origin. Aquifers, Zones of underground water, types of Aquifers. Specific Yield, Storage Coefficient, Ground Water investigations methods-Introduction.		
2	Ground Water Movement: Confined and unconfined flow; Darcy's Law and its validity. Coefficient of permeability & its measurement, Transmissibility steady unidirectional flow – confined and unconfined (Dupuit's theory); its applications.		
3	Ground Water flow principles : Hydrodynamic equation – Generalized Darcy's law. General equation of continuity – Laplace equation. Anisotropic media – equivalent aquifer – two dimensional flow. Anisotropic media equivalent permeability, direction of flow		
4	Salt water intrusion and Artificial Recharge: Occurrence, Ghyben Herzberg relation, Upconing, Methods of control. Check dam, Percolation Tank, Recharge Wells, Rainwater Harvesting.		
5	Well – Hydraulics : Steady radial flow to a well in a confined aquifer and unconfined aquifer. Determination of transmissibility. Unsteady radial flow to a well in confined aquifer – Thies method, Jacob's method. Well loss. Step Drawdown Test.		
6	Tubewells: Types of tubewells, Radial collector wells and Infiltration Gallery, Design of Housing Pipes and Screens, Design of Gravel Pack, Suitability of different methods for construction and development of the tube well.		
7	Pumps for Water Supply : Various types of pumps. Centrifugal pumps – components, working, types, work done, head, power, efficiencies, specific speed, characteristic curves, NPSH, cavitation, Jet pump. Air lift pump, Selection of pumps, series and parallel pump connection, multistage pump.		
8	Ground water Management and Control Groundwater monitoring and assessment, Stage of Groundwater extraction, Introduction of Ground Water Modelling, Groundwater Quality, Contamination of Groundwater. Construction dewatering methods.		
Reference Books			

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B. E. Civil : Regular Program			
Year	III	PROFESSIONAL PRACTICE AND VALUATION	
Semester	II	Type of Subject Core / Departmental Elective / Institute Elective Foundation	Subject Code : CVL1653DECS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Student can able to learn about various methods for allocation of Civil construction work on Contract basis. CO2 Student can able to understand the method of preparing Tender document and inviting Tender. CO3 Students can able to learn about condition of contract and administrative procedure followed for contract. CO4 Student can able to learn about all aspect of Valuation of Real property. CO5 Student can able to understand the process of and Arbitration. CO6 Student can able to understand about resent invention, innovative methods and procedure followed in market of construction industry.			
Unit No.	Topic/Unit		
1	CONTRACT Proposal, Promise, Agreement and Contract Essential requirements of a valid contract Method of execution of work done in Public work department, Factors affecting the selection of mode of execution of work Trade Usages Forms of Contract- Lumpsum, Item rate, Percentage contract Termination of Contracts Types of Contracts- Labour, Negotiated, Schedule of prices, Package deal, Demolition contract Responsibilities of Engineer, Contractor and Owner for contract work Contract document Earnest money deposit, Security deposit and Mobilization fund		
2	TENDER Classification of Tender- Open, Selected and Negotiated tender Typical Tender notice for Advertisement, Common Elements of Tender Form for Comparison Qualification of Contractors Mode of Submission of Tender, Scrutiny of Tender, Modes of Acceptance of Tender, Revocation of Tender, Unbalanced Tender, Liquidated damages, Direct and Indirect costs, Basic price contracts		
3	CONDITION OF CONTRACT General provisions in condition of contract, Typical Clauses for.... storage of tools and materials at site, Appointment of Site engineer, Alterations, Additions and omissions, Inferior materials and workmanship, Extension of time limit administrative procedure followed for civil engineering construction... Administrative Approval and Technical sanctions, Fixing Rate contract, Payment of Running Bill and Final Bill, Price Escalation, Change of Item, Extra item.		
4	VALUATION Cost, Price and Value, Purpose of valuation, Different forms of value Factors affecting changes in market value, Freehold and Leasehold rights in Real property (immovable property) Forms of Lease, head rant and rack rant, Mortgage, Method of valuation for Real property, Outgoings, Capitalized value, Year's purchase, Depreciation and Obsolescence, Depreciations methods, Sinking fund, Annuity, Amortization, Valuation tables, Valuation reports. Fixation of standard rent, Easement right		
5	ARBITRATION Arbitrator, Referee Matters for reference to arbitration Kinds of arbitration Powers of an arbitrator Arbitration Agreement and Revocation Award by an Arbitrator Advantages of Arbitration		
6	ADVANCED TOPICS Topics based on new inventions, customs and innovative methods practiced in current market of construction industry.		
Reference Books			
1	Elements of Estimating and Costing (Professional practice) -S.C.Rangwala Pub., Charotar Book stall.Anand		
2	Estimating and costing – B.N.Dutta, Pub. : S.Dutta and Co.Lucknow.		
3	Estimating and costing – S.P.Chandola and Vazirani, Pub. Khanna Pub.		
4	Textbook of Estimating and costing (Civil Engg.) G.S.Birdie, Pub., Dhanpat Rai Publishing company (P) Ltd., New Delhi.		
5	Estimating, costing, specification and valuation in Civil Engg. M.Chakraborti Pub., M. Chakraborty 10th edition. Kolkata		
6	Valuation of Real properties – S.C.Rangwala pub. Charotar book stall.		
7	Civil Engineering contracts and estimates – Patil (Pub. Orient Longman).		
8	Fundamentals of Public works procedure and Account – K.N.Pandya – pub. P.R.Mehta.		

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B. E. Civil : Regular Program					
Year	III	AIR POLLUTION CONTROL ENGINEERING			
Semester	II	Type of Subject Core / Departmental Elective / Institute Elective Foundation		Subject Code : CVL 1654DECS	
Mode of Transaction		Lectures: 03 Tutorial: 01		Credit /Hours per week: 04/04	
Course Outcome (CO) CO1 To understand the key concepts of air pollution for civil engineers CO2 To understand effects of air pollution on global and local environment CO3 To understand monitoring techniques of air pollution and legal aspects CO4 To understand dispersion of pollutants and application for concentration prediction model CO5 To understand prevention, control and design concepts for gaseous and particulate pollutants for stationary and mobile sources					
Unit No.	Topic/Unit				
1	General: Definitions, importance of air pollution studies, atmospheric composition, Units of measurements, conversion of units				
2	Sources and types of air pollution, Pollutants from different industries, Classification of air pollutants, Particulate and gaseous pollutants, Classification of atmospheric particulates, Physical and chemical properties of particulates				
3	Effects of air pollutants on human health- SO ₂ , CO, particulates, On Plants and vegetation, Global effects- Enhancement of Green House effect, O z o n e layer depletion, Acid Rains- Causes, effects and control				
4	Air sampling, methods and monitoring, Ambient air quality standards, Air Pollution Control Act, Ambient air sampling- Objectives and considerations for representative sample, methods of collection for particulate a n d gaseous pollutants, Stack sampling- Objectives and considerations for representative sample, numerical examples for pollution load				
5	Role of meteorology and topography, Past air pollution disasters, Basic atmospheric variables affecting dispersion- Wind speed and direction, gradient wind, wind velocity profile effect of topography and terrain characteristics, wind rose, Temperature profile, radiation energy balance, lapse rates, atmospheric stability, plume behavior, Stack height criteria, effective stack height, Gaussian plume dispersion model, Numerical examples				
6	In- plant control of air pollution, Control of gaseous pollutants, Control methods for Sulfur dioxide, Control methods for oxides of nitrogen				
7	Control equipment for particulate matter, Types of control equipment- application, advantages and limitations, Design examples of control equipment				
8	Automobile pollution, photochemical reactions, Pollutants from automobile, types of emissions, factors influencing pollutant concentration, control techniques for emissions from automobile				
Reference Books					
1.	Air pollution by H.C.Perkins				
2.	Air pollution : M.N. Rao & H.V.N. Rao				
3.	Air Pollution its Origin and Control- Kenneth Wark, Gecil F Warner, Wayne T Devis				
4.	Hand Book of Air pollution analysis – Edited by Roy M. Harrison and Roger Ferry.				
5.	Air pollution Technology By Dean, E.Painter				
6.	Environmental Engg. by Peavy, Rowe and Tehobanoglous				
7.	Environmental Engg. by G.H.Pandy & G.S.Carney				
8.	CPCB manual for Ambient air quality monitoring and Stack monitoring				

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B. E. Civil : Regular Program			
Year	III	ADVANCED STRUCTURAL ANALYSIS	
Semester	II	Type of Subject Core / Departmental Elective / Institute Elective Foundation	Subject Code : APM1651DECS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Evaluate deflections and rotations in statically determinate and indeterminate beams using Moment area and Conjugate beam methods. CO2 Draw Shear Force, Bending Moment diagrams for structures like beams and frames using column analogy method. CO3 Analyze statically determinate and indeterminate Arch structures CO4 Carry out Plastic analysis of indeterminate beams and design using collapse load criteria. CO5 Analyze curved bars with large initial curvature and thick cylindrical shells. CO6 Evaluate the shear center for thin-walled structural members.			
Unit No.	Topic/Unit		
1	Deflection in Statically determinate beams. Moment area method for slope and deflection. Conjugate beam method for slope and deflection.		
2	Analysis of Statically indeterminate structures. Column analogy method for non-prismatic fixed beam. Castigliano's second theorem for indeterminate beams and trusses.		
3	Analysis of arches Three hinged arches with parabolic, semi-circular and circular profile subjected to different types of loading. Three hinged arches with supports at different level, Two hinged parabolic arches.		
4	Plastic theory: Plastic theory for statically indeterminate beams and frames. Collapse mechanism by using plastic hinge formation, load factor, shape factor. Design of beam for flexure by using collapse load.		
5	Curved bars, shells and thin walled sections: Analysis of bars having large initial curvature, Thick cylindrical shells. Concept of shear center for thin walled sections.		
Reference Books			
1.	Theory of Elasticity by Timoshenko S.P. and Goodier J. M. , McGraw Hill Publication, New Delhi		
2.	Mechanics of Structures, Vol. II by S.B. Junnarkar and H. J. Shah, Charotar Pub. Anand Gujarat		
3.	Indeterminate structural analysis by J. S. Kinney, Oxford & IBH Pub. (Ind.), Addison-wesley publication, Boston (USA).		
4.	Basic Structural Analysis by C.S. Reddy, Tata McGraw – Hill. New Delhi		
5.	Structural Analysis by R C Hibbeler, Pearson Education. USA		

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B. E. Civil : Regular Program			
Year	III	PRESTRESSED CONCRETE	
Semester	II	Type of Subject Core / Departmental Elective / Institute Elective Foundation	Subject Code : APM1652DECS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1: Apply the concept Basic principles of pre-stressing, Materials, in determining Post tensioning and Pre-tensioning cable profile, safe cable zone, analysis of sections under flexure-pressure line-load balancing concept. CO2: Develop various systems of prestressing and types of anchorages used. CO3: Determine different types of losses in prestress. CO4: Calculate short-term and long-term deflection of prestressed concrete flexural members. CO5: Evaluate shear stresses and bond stresses in end blocks. CO6: Design prestressed concrete slabs and beams, and evaluate limit state of collapse under flexure to statically indeterminate structures, water tanks, pipes, etc..			
Unit No.	Topic/Unit		
1	Introduction of Prestressed Concrete Basic principles, materials used, permissible stresses, IS 1343 code provisions.		
2	Systems of Prestressing, Types of Losses and Analysis of Sections Systems of pre-stressing, post tensioning and pre- tensioning, cable profile, bonded and unbonded post tensioned members, types of anchorages used and different types of losses in prestress. Analysis of sections under flexure-pressure line-load balancing concept.		
3	Shear and Bond Stresses in End Blocks Shear and bond stresses in end blocks, transfer of prestress, transmission length, bond stresses, transverse tensile stress, end zone reinforcement, flexural bond stress, Codal provisions for bond and transmission length.		
4	Limit State Method for Design of Prestressed Members. Design for Flexure, Shear, Torsion and serviceability. Design of prestressed concrete slabs and beams. design of statically indeterminate structures, water tanks, pipes, etc. calculation of short term and long-term deflection.		
Reference Books			
1	Prestressed Concrete by N. Krishna Raju, Tata McGraw-Hill Publishing Co., New Delhi.		
2	Prestressed Concrete by S.K. Mallick and A.P. Gupta, Oxford and IBH Publishing Co., New Delhi.		
3	Fundamentals of Prestressed Concrete by N.C. Sinha and S.K. Roy, S. Chand and Co., New Delhi.		
4	Design of Prestressed Concrete Structures by T.Y. Lin. Asia Publishing House, New Delhi.		

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B. E. Civil : Regular Program				
Year	III	MATRIX ANALYSIS OF FRAMED STRUCTURES		
Semester	II	Type of Subject Core / Departmental Elective / Institute Elective Foundation	Subject Code : APM1653DECS	
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04	
Course Outcome (CO)				
CO1: evaluate Static and Kinematic indeterminacy of a framed structure and derive the Stiffness and Flexibility matrices.				
CO2: analyze framed structures by stiffness system approach.				
CO3: analyze framed structures by flexibility system approach.				
CO4: analyze framed structures with elastic supports and under secondary loading effects by stiffness and flexibility system approaches.				
CO5: analyze framed structures by stiffness member approach.				
CO6: analyze framed structures by flexibility member approach.				
Unit No.	Topic/Unit			
1	Fundamentals and Flexibility systems approach: Existing Methods and Principles of Matrix structural Analysis, Static and Kinematic Indeterminacies, Stable and Unstable Structures, Flexibility and Stiffness Influence coefficients. Analysis of Beams, Trusses, Frames and Grids by Flexibility systems approach under loading, pre-strain, temperature and support settlement.			
2	Stiffness Systems Approach: Analysis of Beams, Trusses, Frames and Grids by Stiffness systems approach under loading, pre-strain, temperature and support settlement. Analysis of problems of Elastic Supports by Matrix methods.			
3	Flexibility Member Approach: Analysis of Beams, Trusses, Frames and Grids by Flexibility member approach under loading, pre-strain, temperature and support settlement.			
4	Stiffness Member Approach: Analysis of Beams, Trusses, Frames and Grids by Stiffness member approach under loading, pre-strain, temperature and support settlement. Rotation and transformation of axes in two and three dimensions.			
No.	Tutorial			
1	Fundamental of matrix methods, static and kinematic indeterminacies, structural stability and examples			
2	Analysis of framed structures by stiffness system approach			
3	Analysis of framed structures by flexibility system approach			
4	Analysis of framed structures by stiffness member approach			
5	Analysis of framed structures by flexibility member approach			
Reference Books				
1.	Matrix Analysis of Framed Structures by Weaver W. and Gere J. M., CBS Publishers and Distributors, New Delhi.			
2.	Structure Analysis - A Matrix Approach by Pandit G. S. and Gupta S. P., Tata McGraw Hill Publication.			

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B. E. Civil : Regular Program					
Year	III	CIRCULAR ECONOMY AND SUSTAINABLE DEVELOPMENT			
Semester	II	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : CVL16XXIECS		
Mode of Transaction		Lectures: 02 Tutorial: 01	Credit /Hours per week: 03/03		
Course Outcome (CO)					
CO1 To understand basic concepts of sustainable development					
CO2 To understand the concept of circularity					
CO3 Apply the concept of circular economy to environmental problems					
CO4 Use the principles of circularity for application to sustainable development					
CO5 Apply complexity aspects of circular economy for creating circular business models					
Unit No.	Topic/Unit				
1	Module I: Introduction to Circular Economy and sustainable development Linear Economy and its emergence, Economic and Ecological disadvantages of linear economy, Replacing Linear economy by Circular Economy, Development of Concept of Circular Economy, A differential - Linear Vs Circular Economy				
2	Module II: Characteristics of Circular Economy Material recovery, Waste Reduction, reducing negative externalities, Explaining Butterfly diagram, Concept of Loops				
3	Module III: Circular design, innovation and Assessment Zero waste: Waste Management in context of Circular Economy, Circular design, Research and innovation, LCA, Circular Business Models				
4	Module IV: Case Studies Business models, Solid Waste Management / Wastewater, Plastics: A case study, EPR: polluters pay principle, Industrial symbiosis/ Eco-parks				
5	Module V: Legal and policy framework Role of governments and networks, Sharing best practices, Universal circular economy policy goals, India and CE strategy, ESG				
Reference Books					
1.	Walter R Stahel: The Circular Economy A User's Guide, Routledge; 1st Edition (24 June 2019)				
2.	Shalini Goyal Bhalla – Circular Economy: (Re) Emerging Movement, Invincible Publisher				
3.	Peter Lacy, Jessica Long, Wesley Spindler, The Circular Economy Handbook: Realizing The Circular Advantage, Palgrave Macmillan				
4.	Peter Lacy, Jakob Rutqvist - Waste to Wealth: The Circular Economy Advantage, Palgrave Macmillan				

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B. E. Civil : Regular Program			
Year	III	GIS AND REMOTE SENSING	
Semester	II	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : CVL16XXIECS
Mode of Transaction		Lectures: 02 Tutorial: 01	Credit /Hours per week: 03/03
Course Outcome (CO)			
CO1 Apply the concepts of Electro Magnetic energy, spectrum and spectral signature curves in the practical problems.			
CO2 Apply the concepts of satellite and sensor parameters and characteristics of different platforms			
CO3 Apply the concepts of DBMS in GIS.			
CO4 Analyze raster and vector data and modeling in GIS.			
CO5 Apply GIS in land use, disaster management, ITS and resource information system			
Unit No.	Topic/Unit		
1	REMOTE SENSING Definition -Historical Components of Remote Sensing Principles & methods of remote sensing - Active and Passive remote sensing - Remote Sensing platforms -Electromagnetic radiation- Spectrum-Block body radiation – planks law – Stefan – Boltzmann law – satellites classification – based on orbit- sun synchronous and Geosynchronous based on purpose Earth Resources satellites, communication satellite Weather satellites Spy satellites Sensors Description of sensor in landscape, spot, IRS series and current satellites- Radar SLAR-and SAR.		
2	EMR INTERACTIONS Interaction with atmosphere Scattering of EMR Raleigh, Mie, Non Selective and Raman Scattering Bach scattering Speckle EMR Interaction with water and Ozone Atmospheric windows and its significance EMR interaction with the earth surface materials Radiance, irradiance, Absorbed and Transmitting energy – reflectance- Specular- and diffuse surface- Spectral signature – and curves EMR interaction with soil Resolution Spectral, Spatial, Radiometric, and Temporal.		
3	RESOURCES ENGINEERING Characteristics of Digital satellite image enhancement Filtering Applications of Aerial photographs and satellite imageries – merits – Limitations – Water resources – watershed management – Urban Studies – Flood Management- Fishing Forestry etc.,		
4	GEOGRAPHIC INFORMATION SYSTEM GIS – Components of GIS – Hardware, Software and Organisational Context – Data – Spatial and NonSpatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.		
5	MISCELLANEOUS TOPICS Visual Interpretation of Satellite Images – Elements of Interpretation		
Reference Books			
1	Anji Reddy, “Remote Sensing and Geographical Information Systems”, BS Publications 2001		
2	Anand P.H,”Principles of remote Sensing and Geographical Information Systems”, Sri Venkateswara Publishers, 2003		
3	Lillesand T.M and Kiefer R.W. Remote sensing and Image, Interpretation, John Wiley and Sons, INC, New York, 1987.		
4	Burrough P A,”Principle of GIS for land resource assessment”, Oxford University, 1990		

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B. E. Civil : Regular Program			
Year	IV	WATER RESOURCES AND IRRIGATION ENGINEERING	
Semester	I	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : CVL1701CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1: Understand the irrigation system and to crop water requirements CO2: Select the embankment dams, spillways, energy dissipators and hydropower plants. CO3: Design the components of barrage and canal structures. CO4: Analyze the gravity dam CO5: Design of the various types of canals CO6: Suggest measures for irrigation management and sustainable irrigation development			
Unit No.	Topic/Unit		
1	Introduction : Introduction to water resources of India. Planning of Multipurpose water resources projects, Irrigation Schemes, Estimation of crop water requirement, Crop-soil-water interaction, Methods of Irrigation.		
2	Diversion head works: layout, functions and components. Weir and barrages – cross section, selection of site, Design considerations for barrage on pervious foundation, waterway and looseness factor, impervious floor, cutoff and river bed protection works, Silt management in barrage. Rubber dam and Piano Key weir.		
3	Storage head works : Selection of dam site, types of dams and their selection. Selection of gravity dam, forces acting on gravity dams. Causes of failure and safety criteria, Stability analysis-design, Elementary profile, Foundation treatment, Construction features of gravity dam,		
4	Earth dams : Types of earth dams – components and their functions, Causes of failure; design criteria; Stability Analysis of Slope, Freeboard design considerations, slope protection, Seepage control and prevention measures. Construction features of earth dam. Concrete faced rockfill dam, Roller compacted concrete dam		
5	Spillways: Types of spillways and their suitability, Profile of ogee spillway, Aeration facilities, Energy dissipaters: types and suitability. Reservoir storage zones, Reservoir operation, Sedimentation in reservoirs. Hydropower Plants: components, power estimates. Pumped storage plants, Hydropower generation in canals.		
6	Canals : Canal network, canal cross-section – elements and functions. Design of unlined canal sections- Kannedy’s and Lacey’s theories. Lining of canals-benefits and types of lining, Design of lined canal sections; alignment of canals. Sub minor and UGPL.		
7	Canal structures: Regulation works – Head regulator, Cross regulator, Escapes, Canal falls-functions and types. Design of glacis type fall. Cross drainage works-types, selection, Outlets. Silt management in canals		
8	Irrigation management, Water resources sustainability. River interlinking projects, Tube well irrigation, Lift irrigation, Conjunctive use, Centrifugal pumps for water supply and irrigation.		
Reference Books			
1	Irrigation and Water Power Engineering By Punamia, Lal, Jain and Jain, Laxmi Publications Pvt Limited, 2009		
2	Irrigation Engineering And Hydraulic Structures By Santosh Kumar Garg, Khanna Publishers,2013		
3	Asawa, G.L., “Irrigation and Water Resources Engineering”, New Age International (P) Limited, Publisher, 2005.		
4	A M Michael, “Irrigation Theory and Practice”, 2/e, Vikas Publishing, 2008.		
5	Mays, L.W., “Water Resources Engineering”, John Wiley & Sons, Inc, 2010.		

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B. E. Civil : Regular Program				
Year	IV	WATER RESOURCES AND IRRIGATION ENGINEERING- TW, Pr & Viva		
Semester	I	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : CVL1701LCS	
Mode of Transaction		Term work: 02	Credit /Hours per week: 01/02	
No.	Termwork			
1	Types of irrigation schemes			
2	Stability analysis of earth dam			
3	Design of spillway profile			
4	Design of canal bed profile			
5	Design of canal balance section-developing longitudinal section of a canal			
6	Design of barrage waterways			
7	Design of barrage floor, cutoffs and bed protection			
8	Design of floor thickness of barrage using khosla theory			
9	Design of glacis type fall			
10	Analysis of forces in gravity dam			
11	Stability analysis of gravity dam			
12	Field visit/case study report			

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B. E. Civil : Regular Program			
Year	IV	WATER AND WASTEWATER TREATMENT	
Semester	I	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : CVL1702CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO)			
CO1 To understand basic concepts and unit processes of water and sewage treatment and sewerage system			
CO2 To design conventional water treatment plant units			
CO3 To design conventional sewage treatment plant units and sewerage system			
CO4 To understand basic aspects of disposal of treated sewage			
CO5 To understand basic aspects of material balance			
Unit No.	Topic/Unit		
1	Sewage Treatment: fundamentals, Objectives, Unit operations- Dry well, Wet well		
2	Screening, Grit removal: types and design, Sedimentation, Primary Settling Tanks		
3	Water Treatment: Objectives, Various treatment options, Sedimentation- Theory, Types of settling, Settling tank features and types, design of sedimentation tank, Sedimentation aided with coagulation, coagulants, Rapid Mixing & Slow Mixing Devices - Hydraulic & Mechanical mixing, design examples, Filtration- Mechanism, types of filters, operation and design examples of rapid sand gravity filter, Disinfection- theory, chemical disinfectants, chlorination, numerical examples		
4	Biological unit process and disposal of treated sewage: Basic concepts of biodegradation (electron donor and electron acceptor), Basic concepts of biodegradation (aerobic, facultative, and anaerobic processes), Microbial growth requirement, Biological growth curve, mixed culture and types of microbes, Attached growth processes: basic concepts, construction and operation of Trickling filter, Trickling filter problems and maintenance, Design examples of Trickling filter, Suspended growth processes: basic concepts, construction and operation of Activated sludge process, Design and operational parameters of ASP, types of aeration systems, Modifications of ASP, Examples on Design and operation of ASP		
5	Onsite sewage treatment systems: Septic tank, principle of action, construction and operation, Design of septic tank and soak pit, Basics of anaerobic digestion, process biochemistry, Products of anaerobic digestion, types of anaerobic digesters, Design examples of anaerobic digesters		
6	Design of sewers, sewer appurtenances: Hydraulic design of sewers- Flow estimation- Quantity of sanitary sewage, variations in sewage flow, peak factors, Storm water flow estimation- Rational formula, rainfall intensity, time of concentration, Flow equations, pressurized flow, open channel flow- Manning’s formula, charts and nomograms, shapes of sewer, Velocity considerations- Self cleansing and non-scouring velocity, Partial flow condition, hydraulic elements of circular sewer, Numerical examples based on sewer design, Sewer material and Sewer appurtenances		
7	Disposal of treated sewage, receiving water bodies and their effluent standards, stream pollution and DO sag curve, Disposal of treated sewage on land for irrigation		
8	Material Balance- Steady state conservative system, steady state system with non-conservative pollutants		
Reference Books			
1.	Metcalf & Eddy : Wastewater Engineering- Treatment and Reuse		
2.	Environmental Engg. by Peavy, Rowe and Tehobanoglous		
3.	Wastewater Treatment Concept and Design Approach by G.L. Karia, R.A. Christian, Namrata D. Jariwala		
4.	Water Supply Engineering by Santosh Kumar Garg		
5.	Wastewater Engineering by Santosh Kumar Garg		
6.	G.S.Birdi, ‘Water supply and sanitary Engg.’		
7.	Water Supply Engineering by Punmia and Jain		
8.	Wastewater Engineering by Punmia and Jain		
9.	Introduction to Environmental Engg and Science by Gilbert M. Masters		
10.	CPHEEO Manual on water supply and treatment, Ministry of urban development, New Delhi.		
11.	CPHEEO Manual on sewerage and sewage treatment, Ministry of urban development, New Delhi		

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B. E. Civil : Regular Program			
Year	IV	WATER AND WASTEWATER TREATMENT- TW, PR & VIVA	
Semester	I	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : CVL1702LCS
Mode of Transaction		Termwork: 02	Credit /Hours per week: 01/02
No.	Termwork		
1	Design and detailed engineering drawing of conventional Water treatment plant		
2	Design and detailed engineering drawing of conventional Sewage treatment plant		

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B. E. Civil : Regular Program			
Year	IV	HIGHWAY & AIRPORT ENGINEERING	
Semester	I	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : CVL1703CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Understand and learn highway development, highway planning basics CO2 Design the geometry of roads with proper alignment. CO3 Plan and conduct traffic studies for traffic management CO4 Analyse and design flexible and rigid pavements CO5 Construct the pavement by selecting appropriate materials and workout maintenance strategies. CO6 Understand and Learn the airport Planning, design of runway geometry and air traffic aids			
Unit No.	Topic/Unit		
1	Highway Development and Planning Role of Roads in the development of nation, Planning concepts, Necessity, Road development Plan of India, Role of various organization, Master Plan, Financing, organizations		
2	Geometric Design Geometric Designs of Highways and Roads in Urban Areas, Design of OSD, SSD, Super elevation, Horizontal and Vertical curve, transition curve, Setback distance Classification and consideration in fixing alignment of roads		
3	Traffic Engineering Introduction of Traffic Engineering, Traffic Volume, density, Capacity, Factors affecting PCU value, Surveys and design and control measures for traffic, intersections design and problem, Traffic flow characteristics		
4	Highway Material Materials (Soil, Aggregate and Bitumen) for road construction their properties and significance		
5	Pavement Design Introduction of Pavement design, Types and Factors affecting the pavement design, design of Flexible and Rigid Pavement as per IRC guidelines		
6	Highway Construction Road construction equipment and construction methods for Non bituminous, Bituminous and cement concrete pavement construction		
7	Highway Maintenance Routine and periodic maintenance of Highways, Maintenance of rigid and flexible pavement		
8	Airport Engineering Airport Planning – classification – site selection, runway orientation, imaginary surfaces, Airport obstructions, Layouts of airports – geometric design of runway and taxiway, visual and air traffic control aids, Terminal area design		
Reference Books			
1. Khanna, Justo & Veeraghvan, Highway Engineering, Pub: Nem Chand & Bros, Roorke 2. Chakroborty & Das, Principles of Transportation Engineering, Pub: PHI learning Pvt. Ltd. 3. S. K. Sharma, Principles Practice and Design of hihway Engineering, S Chand Pvt. LTd. 4. Prithvi Singh Kandhal, Bituminous Road Construction in India, Pub: PHI learning Pvt. Ltd. 5. Principles of pavement design: by Yoder and Witezak (Second edition)- Publisher: john Wiley and sons. 6. Pavements and surfacing for Highway and airports: by Michel Sargious (1975) – Publisher: Applied science publishers ltd. 7. Pavement management systems: by Hose and Hudson- Publisher: McGraw Hill 8. Thickness design – asphalt pavement structures for Highway and streets – Publisher: Asphalt Institute (US) 9. Khanna and Arora, Airport Planning and design Pub. Nemchand & Sons Roorkee 10. Sehgal and Bhanot, A Text book of Highway & Airport Engg. S.Chand and Co. 11. Horonjeiff, Mckelvy, Sproule & Young, The planning and design of Airport –Pub. McGraw Hill Co. 12. IRC – Hand book of Quality control for construct ion of Roads and runways 13. MORT&H (5 TH Revision) – Specifications for Road and Bridges 14. Codes-IRC-37,IRC-58, IRC-SP-17			

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B. E. Civil : Regular Program			
Year	IV	HIGHWAY AND AIRPORT ENGINEERING - TW, PR & VIVA	
Semester	I	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : CVL1703LCS
Mode of Transaction		Termwork : 02	Credit /Hours per week: 01/02
No.	Practical and Termwork		
1	Testing and evaluating the various properties of Soil and Road Aggregates CBR test, Crushing Test, Impact, Shape Test, Los Angles Abrasion test, Sp. Gravity , Bulk Density and Water Absorption test		
2	Testing and evaluating the various properties of Road Bitumen Penetration Test, Softening Test, Absolute viscosity test, Kinematic viscosity test, Ductility test		
3	Quality control test of Bituminous Mix Bitumen content test of Bitumen Mix		
4	Orientation of Runway using Wind Rose Diagram		
5	Field survey and analysis of Traffic Volume count		

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B. E. Civil : Regular Program			
Year	IV	DESIGN OF RCC AND STEEL STRUCTURES	
Semester	I	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : APM1701CS
Mode of Transaction		Lectures: 03 Tutorial: 01	Credit /Hours per week: 04/04
Course Outcome (CO) CO1 Analyze and Design RCC column, using design aids. CO2 Analyze and Design RCC isolated footings CO3 Design RCC combined footing. CO4 Design steel Plate Girders, Stanchions and connection for shear and Moment. CO5 Design eccentrically loaded steel column. CO6 Design steel column bases			
Unit No.	Topic/Unit		
1	Design of RCC column Design of RCC axially loaded column, column subjected to axially loaded and uniaxial bending, column with axial load and Bi- axial bending, and slender columns.		
2	Design of RCC footing Design of isolated footing-sloped type and pad type, design of wall footing. Design of footing for axial load with uniaxial moment and biaxial moment Design of different types of combined footing.		
3	Design of Plate Girders, and Built-up Stanchions. Design of connection for shear and Moment. Design and detail of plate girders with curtailment of flanges, Design of axially loaded built up columns with lacings and battens. Design of connections for shear and moment, Cased stanchions,		
4	Design of Eccentrically Loaded Stanchions, column Bases and Design Problem of Steel Building. Design and detailing of Eccentrically loaded stanchions as per Indian standards. Design of Slab bases, Gusseted bases, bases subjected to bending about two axes. Design of steel building using IS codes.		
Reference Books			
1.	Reinforced concrete Vol. I and II by H. J. Shah, Charotar Pub.		
2.	Reinforced concrete by S.K. Mallick and Gupta, Oxford & IBH Pub.		
3.	Reinforced concrete by Sinha and Roy.		
4.	Steel structures by A.S.Arya and Ajmani, Nemchand & Bros.		
5.	Design of steel structures by Kazimi and Jindal, Prentice Hall Pub.		
6.	Steel Designer's Manual, ELBS Pub.		
7.	Steel Structures by T.J. Macginiely, E & F N SPON.		
8.	Steel Structures by Raghupathi, Tata McGraw Hill Pub.		
9.	Limit State Theory and Design of Reinforced Concrete by S. R. Karve and V. L. Shah, Structures Publishers, Pune, 2003.		
10.	IS:4326-1993 “Code of Practice for Earthquake Resistant Design and Construction of Buildings”, BIS, New Delhi, 1993.		

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B. E. Civil : Regular Program			
Year	IV	DESIGN OF RCC AND STEEL STRUCTURES -TW, PR & VIVA	
Semester	I	Type of Subject Core / Departmental Elective / Institute Elective / Foundation	Subject Code : APM1701LCS
Mode of Transaction		Termwork: 02	Credit /Hours per week: 01/02
No.	<u>DESIGN and DRAWING</u>		
1	Design of RC framed structure for gravity load (G+2)		
2	Design of columns and footing		
3	Design of plinth beam and ground beam		
4	Design of floor beam and slab		
5	Design of Plate Girder		
6	Design of steel building		

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B. E. Civil : Regular Program			
Year	IV	PAVEMENT DESIGN AND CONSTRUCTION	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : CVL1704DECS
Mode of Transaction		Lectures: 03	Credit /Hours per week: 03/03
Course Outcome (CO)			
CO1 Understand the basic principles of pavement design			
CO2 Analyse and design the flexible and rigid pavement according to various codes			
CO3 Construct the pavement by selecting appropriate materials, equipment and construction procedure			
CO4 Design the bituminous mix as per laboratory procedure			
CO5 Identify the maintenance strategies for flexible and rigid pavement.			
Unit No.	Topic/Unit		
1	Introduction to Pavement Basics: Pavement types, Structures, field tests, Factors affecting design and performance of Highway pavements, Pavement components and their function; behavior under sustained and repeated loading		
2	Pavement Mix design : Objectives of Mix Design, Blending of aggregate, Properties of various mixes, mix design method:- Marshal mix design		
3	Flexible Pavement design methods for Highway: Empirical, Semi-empirical and mechanistic approaches of flexible pavement design using the specified IRC codes.		
4	Rigid Pavement design methods for Highway: Different approaches and general considerations in the design of rigid pavement using IRC codes, Types of joints, Spacing and joint details for longitudinal joints, Construction and expansion joints, design of dowel bar and tie bar		
6	Construction Methods: Different types of low, Intermediate and high type pavements, WBM, WMM, Gravel road, bituminous road, Cement concrete pavements, Recycled asphalt pavement, Micro-surfacing.		
7	Equipment: Introduction to machineries used in road construction, use of machinery, owning and operating cost per hour.		
Reference Books			
1. IRC – Hand book of Quality control for construct ion of Roads and runways 2. MORT&H (5 TH Revision) – Specifications for Road and Bridges 3. Khanna, Justo & Veeragvan, Highway Engineering, Pub: Nemchand & Bros, Roorke 4. Chakroborty & Das, Principles of Transportation Engineering, Pub: PHI learning Pvt. Ltd. 5. S. K. Sharma, Principles Practice and Design of highway Engineering, S Chand Pvt. LTd. 6. Prithvi Singh Kandhal, Bituminous Road Construction in India, Pub: PHI learning Pvt. Ltd. 7. Principles of pavement design: Yoder and Witezak (Second edition)- Publisher: john Wiley and sons. 8. Pavements and surfacing for Highway and airports: Michel Sargious (1975) – Publisher: Applied science publisher’s ltd. 9. Pavement management systems: Hose and Hudson- Publisher: McGraw Hill 10. Thickness design – asphalt pavement structures for Highway and streets – Publisher: Asphalt Institute (US) 11. Codes-IRC-37,IRC-58, IRC-SP-17			

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B. E. Civil : Regular Program					
Year	IV	PAVEMENT DESIGN AND CONSTRUCTION -TERMWORK			
Semester	I	Type of Subject Core -/ Elective / Foundation		Subject Code : CVL1704LDECS	
Mode of Transaction		Laboratory: 02		Credit /Hours per week: 01/02	
No.	Termwork				
1	Sieve Analysis of Aggregates a. Gradation of aggregate for different design Mix b. Graph plotting and find out type of aggregate Uniform grading, gap grading etc..				
2	Blending of Aggregates a. Two aggregate blending b. Three aggregate blending				
3	Bituminous Mix Design by Marshal Method a. Understand the procedure of Marshal Specimen preparation b. Gradation of Aggregate c. Blending of Aggregate of required Mix the d. Prepare the Marshal Specimen for hot mix e. Testing of Specimen f. Analysis of Result and computation of OBC				
4	Assignment based on design of flexible and rigid pavement				
5	Field Visit of Hot Mix Plant and Highway Construction Site (Any one term of term-work class)				
6	Field visit for direct observation of distress in pavement				

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B. E. Civil : Regular Program				
Year	IV	ADVANCED WATER AND WASTEWATER TREATMENT		
Semester	I	Type of Subject Core- / Elective / Foundation	Subject Code : CVL1705CS	
Mode of Transaction		Lectures: 03	Credit /Hours per week: 03/03	
Course Outcome (CO) CO1 To understand purpose and classification of water and wastewater treatment processes and consequent pollutants removal CO2 To understand basics of advanced water and wastewater treatment processes CO3 To design of advanced water and wastewater treatment processes CO4 To recognize presence of emerging pollutants in aquatic system and their sources CO5 To understand advanced methods of analysis for the micro pollutants in water and wastewater				
Unit No.	Topic/Unit			
1	Classification of treatment techniques, Basic purpose and consequent pollutants removal. Standards for water quality and wastewater disposal.			
2	Advances in sedimentation, filtration and disinfection processes			
3	Softening: Lime Soda Process, Excess lime treatment Process Zeolite Process (cation Exchange Process), Demineralization by Ion-exchange			
4	Tertiary treatment for removal of residual organics, removal of nutrients,. Membrane Filtration Technology. Working principle, ultra-filtration, reverse osmosis application, electro-dialysis. Adsorption.			
5	Advanced biological wastewater treatment technologies- modifications of activated sludge process, sequential batch reactor, Moving bed Bioreactors, Membrane bioreactors, Advanced anaerobic treatment processes UASB, other hybrid processes.			
6	Emerging pollutants – Pharmaceuticals and personal care products (PPCPs) in drinking water: sources, their effects, and mitigation measures. Advanced methods of water analysis Optical methods of analysis (Absorption and emission spectrophotometry, Infrared spectroscopy); Chromatographic methods of analysis (Gas chromatography, liquid chromatography)			
Reference Books				
1.	Metcalf & Eddy : Wastewater Engineering- Treatment and Reuse			
2.	Water supply and Sanitary Engg. by G.S.Birdie			
3.	Water Supply Engg. by Santosh kumar Garg			
4.	Sewage Disposal and Air Pollution Engineering by Santosh kumar Garg			
5.	CPHEEO Manual on water supply and treatment, Ministry of urban development, New Delhi.			
6.	CPHEEO Manual on sewerage and sewage treatment, Ministry of urban development, New Delhi			
7.	Water Works Engineering- Planning, Design and Operation by Syed R. Qasim, Edward M. Motley, Guang Zhu			
8.	Environmental Engineering by Peavy, Rowe and Tehobanoglous			

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B. E. Civil : Regular Program			
Year	IV	ADVANCED WATER AND WASTEWATER TREATMENT	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : CVL1705LCS
Mode of Transaction		Termwork: 02	Credit /Hours per week: 01/02
No.	Term work		
1	Design and detailed engineering drawing of advanced water and wastewater treatment units		

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B. E. Civil : Regular Program					
Year	IV	ADVANCED FLUID MECHANICS			
Semester	I	Type of Subject Core- / Elective / Foundation		Subject Code : CVL1706DECS	
Mode of Transaction		Lectures: 03		Credit /Hours per week: 03/03	
Course Outcome (CO) CO1 Students are made aware about Dimensional Analysis, Model studies and computational fluid dynamics. CO2 Students are made aware about Open Channel flow including complex flow conditions like gradually and spatially varied flow and concept of flow around solid boundaries (Boundary Layer Flow) CO3 Students are made aware about Hydrostatic Forces on submerged surfaces, Buoyancy, Floatation, Relative Equilibrium and Impact of Jet. CO4 Students are made aware about hydraulic transient flow (Water Hammer and surges), Source and Sink phenomena.					
Unit No.	Topic/Unit				
1	Flow around submerged bodies and boundary layer theory: Forces due to fluid flow-viscous drag, pressure drag and lift, Boundary layer theory Laminar and Turbulent Boundary layer Boundary layer, Thickness, Displacement thickness, momentum thickness. Boundary layer equation. Momentum equation for laminar Boundary layer on flat plate. Turbulent and transitional boundary layer over flat plate. Boundary layer separation and its control stream lined bodies. Drag and lift for flow around cylinder, sphere and flat plate, Free fall of a body through fluid				
2	Dimensional and model analysis: Physical quantities and their dimensions. Dimensional homogeneity. Rayleigh's method. Buckingham's II theorem method. Utility of model analysis. Hydraulic similitude. Model laws. Scale effect, ship-model testing. Distorted models.				
3	Hydrostatic forces on submerged surface areas: Plane and curved, Total pressure curved. Resultant pressure and center pressure and their computations. Buoyance – stability of floating and submerged bodies, Metacentre and its determination. Relative equilibrium – motion with linear uniform acceleration and uniform rotation.				
4	Introduction to Computational Fluid Dynamics: Input the problem geometry, generate the grid, and define the flow parameter and the boundary conditions. Methods used to solve the governing equations. By finite difference method; By finite element method, By finite volume method.				
5	Flow through open channel: Steady - non uniform flow, Gradually varied flow- differential equation, water surface profiles, Backwater and Drawdown curves, Length of Gradually Varied Flow. Rapidly varied flow- hydraulic jump in rectangular channels, sequential depths, loss of energy, Types of hydraulic jump, Use of Hydraulic jump, Surges in open channel.				
6	Pipe Flow: Pipe line with pump/turbine, pipe network. Water hammer in pipes-its effects, Rigid water columns theory, elastic water column theory- sequence of events, pressure wave and its velocity. Transient flow, Surge tank - uses and types				
7	Impact of jets :- Impact of Jet on Stationary and moving vanes, Flat and curves, flow over radial vane, applications				
8	Source and Sink :- Introduction to Source, Sink and related terms as well as equations, combined flow filed of Source and Uniform flow – Flow past Rankine’s Half Body, Physical features of a Combined flow field of Source and Uniform flow.				
Reference Books					
1.	Dave R.M., Fluid Mechanics part II				
2.	Kumar K.L., Engineering Fluid Mechanics				
3.	Mody P.N. & Sheth S.M., Hydraulics & Fluid Mechanics, Standard Book House.				
4.	Ramamurtham S., Hydraulics, Fluid Mechanics and fluid machines, Dhanpat Rai Publishing Company, New Delhi.				
5.	Bansal R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications.				
6.	Chow Ven Te, Open channel Hydraulics				
7.	Massary, Fluid Mechanics				
8.	Garde R.J. & Mirajgaokar A.J., Engineering Fluid				
9.	Garde R.J., Fluid Mechanics through Problems, New Age International Publishers.				

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B. E. Civil : Regular Program				
Year	IV	ADVANCED FLUID MECHANICS		
Semester	I	Type of Subject Core-/ Elective / Foundation	Subject Code : CVL1706LDECS	
Mode of Transaction		Practicals: 02	Credit /Hours per week: 01/02	
No.	Practical Name			
1	Study of element of Hydraulic jump occurring in stilling basin			
2	Metacenter and Meta centric height			
3	Tracing out the water surface profile for Drawdown curve for flow in open channel			
4	Tracing out the water surface profile for Backwater curve for flow in open channel			
5	Determination of Up surge and Down surge height surge tank for Transient flow in pipe line			
6	Determination of impact of water Jet for free flow condition.			

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B. E. Civil : Regular Program			
Year	IV	GIS APPLICATIONS IN CIVIL ENGINEERING	
Semester	I	Type of Subject Core - Elective / Foundation	Subject Code : CVL1707DECS
Mode of Transaction		Lectures: 03	Credit /Hours per week: 03/03
Course Outcome (CO)			
CO1 Understand concept of Geographic Information System and its application in Civil Engineering			
CO2 Preparation of geospatial features in computing environment			
CO3 Analyze geospatial data for solving problems of natural and Civil Engineering systems			
CO4 Create GIS and cartographic outputs for presentation			
CO5 Apply the geospatial skills in implementing a GIS Project			
Unit No.	Topic/Unit		
1	Introduction – GIS definition, development, application areas.		
2	Map Concept- Map-Definition, Elements of Maps, Types of maps, Advantages and disadvantages of analog/digital maps, Coordinate Systems- Geometric models of earth, Global/Local coordinate system, Projection Systems- Classification, Cylindrical projection, Conical projection, Selection of a particular projection.		
3	Fundamental concepts of GIS – Modeling Real World Features- Raster data model, vector data model, Data Formats- Spatial and Non-Spatial data		
4	Database preparation and editing- Data collection and Input, Data conversion, Hardware & software Requirements, Topology – Editing and Error Rectification, Types of topology, Topological Relationships.		
5	Spatial Analysis – Buffer Analysis-Variations in Buffering, Applications of buffering, Overlay Analysis-Feature type and overlay, Vector Overlay methods, Network Analysis-Impedance, Shortest path analysis, closest facility, Concepts of Proximity analysis, Neighborhood operations, DEM and TIN.		
6	GIS Project Planning – Steps in GIS project, Problem Identification and Implementation of a GIS project.		
7	GIS Applications – Transportation, Water Resources, Environment, Geology, Emergency Management, Agriculture, Urban planning, climate change, Business		
8	Advances in GIS – Concepts and application of open source Mobile and Web GIS.		
Reference Books			
1	Kang-Tsung Chang, Introduction to Geographic Information Systems, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2015		
2	C.P. Lo, Albert K. W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice Hall India Pvt. Ltd, New Delhi, 2009		
3	Peter A. Burrough and Rachael A. McDonnell, Principles of Geographical Information Systems, Oxford University Press, 2016		

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B. E. Civil : Regular Program				
Year	IV	ELECTIVE- GIS – APPLICATIONS IN CIVIL ENGINEERING TERMWORK		
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : CVL1707LDECS	
Mode of Transaction		Termwork : 02	Credit /Hours per week: 01/02	
No.	Term-work			
1	Lab assignments based on design of basic data structures applicable to Civil Engineering			
2	Lab assignments based on digitization work including georeferencing and attribute use			
3	Lab assignments based on spatial analysis			
4	Case study			

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B. E. Civil : Regular Program			
Year	IV	ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES	
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : APM1702DECS
Mode of Transaction		Lectures: 02 Tutorial: 01	Credit /Hours per week: 03/03
Course Outcome (CO) CO1 Analyze, design and detail RC multi-storied building for gravity and lateral loading including earthquake. CO2 Analyze, design and detail RC flat slab. CO3 Design and detail pile foundation. CO4 Design and detail RC retaining wall. CO5 Design and detail RC water tank resting on ground. CO6 Design underground RC water tank.			
Unit No.	Topic/Unit		
1	Analysis and design of RC multistorey Building & Flat slab Building frames including portal frames: Gravity loads - Area method and Beam reaction method of analysis- Substitute frame - Arrangement of live loads - Two cycle method - Redistribution of moment and frame analysis - Wind and earthquake loads - Complete building design problem-Detailing of Reinforcements using IS 13920. Flat slabs - Circular slabs.		
2	DESIGN OF RC RETAINING WALL Cantilever and Counter fort type Retaining walls.		
3	DESIGN OF RC WATER TANK USING LIMIT STATE METHOD Introduction to IS 3370-2023, R.C.C. Water tanks - Rectangular and circular tanks, Underground and resting on ground tanks.		
4	DESIGN OF RCC PILE and RAFT FOUNDATIONS Introduction to deep foundation, Pile design, Under reamed pile, Friction pile, Design of Pile cap for double pile, 3 pile group, 4 pile groups.		
Reference Books			
1.	Reinforced Concrete, Vol. I and II by H.J.Shah, Charotar Pub.		
2.	Reinforced Concrete by S.K.Mallick & Gupta, Oxford & IBH Pub.		
3.	Continuity in Building Frames-Portland cement association, USA.		
4.	IS:1893-2002 “Criteria for Earthquake Resistant Design of Structures-Part I: General Provisions for Buildings”, BIS, New Delhi, 2002.		
5.	IS:13920-1993 (2003) “Indian Standard Code of Practice for Ductile Detailing of Reinforcement Concrete Structures subject to seismic Forces”, BIS, New Delhi, 1993 (2003).		

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B. E. Civil : Regular Program				
Year	IV	ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES-LAB		
Semester	I	Type of Subject Core / Elective / Foundation	Subject Code : APM 1702LDECS	
Mode of Transaction		Term work: 02	Credit /Hours per week: 01/02	
No.	<u>DESIGN AND DRAWING</u>			
1	Design of Multi-Story Building For Earthquake forces			
2	Design Of Retaining Wall			
3	Design Of Flat Slab			
4	Design Of RCC Pile And Raft Foundations			
5	Design Of U/G And O/H Water Tank Using Limit State Method			

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B. E. Civil : Regular Program					
Year	IV	ADVANCED DESIGN OF STEEL STRUCTURES			
Semester	I	Type of Subject Core/ Elective / Foundation		Subject Code : APM1703DECS	
Mode of Transaction		Lectures: 02 Tutorial: 01		Credit /Hours per week: 03/03	
Course Outcome (CO) CO1 analyze and design different types of purlins. CO2 Analyze, design and detail roof truss and lattice girder. CO3 Design and detail steel stanchion without gantry. CO4 Design and detail steel stanchion with gantry. CO5 Design and detail pre-engineered steel structure CO6 Design and detail foot over bridge.					
Unit No.	Topic/Unit				
1	DESIGN OF CONVENTIONAL INDUSTRIAL BUILDING Introduction to industrial bent. Roof covering - A.C. and C.G.I. Sheets - Codal provisions. Gantry girders. Purlin and side sheeting runners - angle, tube and Z section - Fabricated Purlin - Purlin with sag rods. Roof trusses and lattice girders.				
2	DESIGN OF STEEL BUILDING COMPONENTS. Side stanchion - Crane stanchion - Gable stanchion - Wind bracings - Column bases - Foundations.				
3	DESIGN OF PRE-ENGINEERED BUILDING Introduction to PEB. Terminology used in PEB, Design of PEB Steel portal. Different loading and bracing design.				
4	DESIGN OF STEEL FOOT BRIDGE. Importance and components of foot bridge. Loading for foot bridge. Analysis for moving load. Design of different components of foot bridge.				
Reference Books					
1.	Design of Steel Structure By S K Duggal				
2.	Design of Steel Structure By S Shiyekar				
3.	Steel Structures by Raghupathi, Tata McGraw Hill Pub.				
4.	Steel Structures by N. Subramanian.				
5.	Steel Designer's Manual - ELBS Publications.				
6.	Steel Structures by T.J.Macginley, E & F N SPON.				

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B. E. Civil : Regular Program				
Year	IV	ADVANCED DESIGN OF STEEL STRUCTURES		
Semester	I	Type of Subject Core -/ Elective / Foundation	Subject Code : APM1703LDECS	
Mode of Transaction		Term work : 02	Credit /Hours per week: 01/02	
No.	Design examples with drawings			
1	Design of conventional industrial building			
2	Design of steel building components.			
3	Design of pre-engineered building			
4	Design of steel foot bridge.			

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B. E. Civil : Regular Program					
Year	IV	ADVANCED PROGRAMING IN STRUCTURAL ENGINEERING			
Semester	I	Type of Subject Core- Elective / Foundation		Subject Code : APM1704DECS	
Mode of Transaction		Lectures: 02 Tutorial: 01		Credit /Hours per week: 03/03	
Course Outcome (CO) CO1: Create computer programs of general problems after learning programming fundamentals. CO2: Develop programs of civil - structural engineering problems and numerical methods CO3: Write Sub programs using structured programming required for programming of matrix methods. CO4: Create programs on matrix methods and use commercial structural engineering software. CO5: Solve structural analysis problems such as Eigen value problems etc. using numerical methods including finite element method. CO6: Analyze 1D and 2D structural problems using Finite difference method.					
Unit No.	Topic/Unit				
1	Programming Fundamentals: Overview of programming basics, Data Types, Logical operations, Transfer of control statements. Loops, Sequential and direct access file manipulation commands.				
2	Structured Programming Array variables and looping for Reading and writing arrays, Subprograms, Advanced programming. Programming for graph plotting, Introduction to micro computer graphics, Programming of numerical methods.				
3	Computer Implementation to Structural Engineering problems Programming of Structural Engineering problems and Matrix Methods				
4	Numerical Methods In Engineering and Application Software: Relaxation methods Eigen value and Eigen vector problems. Finite difference methods for ordinary and partial difference equation problems. Introduction to the Finite Element Method - One dimensional application. Introduction to application soft wares such as Excel, AutoCAD, STAAD.Pro and their uses in Civil Engineering.				
Reference Books					
1.	The C Programming Language – Ritchie, D. M. and Kernighan, B. W., 2 nd Edition, Pearson India, 2008.				
2.	Let us C - Authetic guide to C Programming Language, BPB Publications, 19 th Edition, Dec - 2022				
3.	Computer Programming in Fortran 90 and 95 by V Rajaraman, Prentice Hall of India Pvt Ltd, 2008				
4.	Mastering EXCEL – Gini Courter and Annette Marquis, BPB Publication, 2002.				
5.	Computer Oriented Numerical Methods – Rajaraman V., Prentice-Hall India.				

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B. E. Civil : Regular Program				
Year	IV	ADVANCED PROGRAMMING IN STRUCTURAL ENGINEERING		
Semester	I	Type of Subject Core/ Elective / Foundation	Subject Code : APM1704LDECS	
Mode of Transaction		Laboratory: 02	Credit /Hours per week: 01/02	
No.	Experiment			
1	Programming: General Applications			
2	Programming: Civil –Structural Engineering Applications			
3	Programming of Numerical Methods			
4	Programming of Matrix Methods			
5	Preparing report on Steps for analysis and design of structures using commercial software			
6	Solution of Eigen value problems			
7	Solution of structural mechanics problems by Finite Difference method			
8	Preparing report on FEM and solution of 1D structural mechanics problems			

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B. E. Civil : Regular Program				
Year	IV	PROJECT WORK IN A GROUP		
Semester	I	Type of Subject Core- / Elective / Foundation	Subject Code : CVL1801LCS	
Mode of Transaction		Project	Credit /Hours per week: 04/08	
Course Outcome (CO) CO1 Understand application of Civil Engineering basics in industries/field/site CO2 Learn the Civil engineering features/designs/safety with respect to sustainable environment CO3 Analyze the field problems and solutions of natural and Civil Engineering systems CO4 Understand the concept of the safe design and safe operation of Civil Engineering structures CO5 developing skill/ software application on project work and application in Societal issues/problems, developing a skill to work in a group work and leadership				
Unit No.	Topic/Unit			
1	Civil Engineering Project			

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B. E. Civil : Regular Program					
Year	IV	INTERNSHIP			
Semester	I	Type of Subject Core-/ Elective / Foundation		Subject Code : CVL1802LCS	
Mode of Transaction		Industrial/field/construction project training/internship		Credit /Hours per week: 12/24	
Course Outcome (CO) CO1 Understand application of Civil Engineering basics in industries/field/site CO2 Learn the Civil engineering features/designs in with respect to sustainable environment CO3 Analyze the onsite/field problems and solutions of natural and Civil Engineering systems CO4 Understand the concept of the safe design and safe operation of Civil Engineering structures CO5 Gain an experience and practice and developing skill on onsite/industrial/Construction project work and application in Societal issues/problems					
Unit No.	Topic/Unit				
1	Internship/Training				