PSO for B.E. (Civil -IWM)

PSO1: Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application-oriented solutions.

PSO2: Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Applied Physics**		**Academic Year**	**2022-23**
B.E. (Civil, Mechanical, Civil -Irrigation and Water Management): Regular Programme				
Year	**I**	~~**Core**~~ **/ ~~Elective / Foundation~~** **APH1XXX: Applied Physics**	**Credits / Hours per week**	**06 hrs/05 (credits) (04 credits for Lecture and Tutorial + 01 credit for Practical)**
Semester	**I**	Year of Introduction: 2022 Year of Syllabus Revision: 2022	**Maximum Marks / Grade**	**100 (Theory) + 50 (Practical)**
Mode of Transaction		**Lectures/ Tutorials/Practical: 03:01:02**		

Course Outcome (CO) APH1109CS

CO1 Understand the basics of laws governing physical world

CO2 understanding the basics of solar photo voltaic system

CO3 Understanding the basics of sound and electro magnetic waves

CO4 Application of physical laws in various engineering applications

Unit No.	**Topic/Unit**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional(R)/Global (G) developmental needs	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	**Electromagnetic Waves:** ▪ Basic laws and equations. Application for devices and instrumentation, Microscopes, Telescopes and camera, Resolution and magnifications, Optical vibration and correction.	09	23	1,2	CO1 CO3 CO4	PSO1 PSO2	Emp. Ent	L, N, R, G	ES

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	08	21	1,2	CO1 CO4	PSO1 PSO2	Emp. Ent	L, N, R, G	ES
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))	09	23	1,2,3,4	CO1 CO3	PSO1 PSO 2	Emp. Ent	L, N, R, G	ES
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	09	23	1,2,3,4	CO1 CO2	PSO1 PSO2	Emp, Ent	L, N, R, G	ES
5.	**Introduction to physics of Buildings** • Heat transfer and air circulation in buildings, effects of thermal expansion	04	10	1,2,3,4	CO1 CO3 CO4	PSO1 PSO2	Emo, Ent	L, N, R, G,	ES

Suggested Reference Books:	
1.	Engineering Physics: by R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications (P) Ltd. 8th 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. 8th Edition
4.	Building Physics: Heat, Air and Moisture, 3rd edition, Hugo S. L, Hens, Wiley
5.	Stephen J. Fonash, "Solar Cell Device Physics", 2nd edition, Academic Press, 2003.

Tutorials will be based on above topics.

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**		**Academic Year**	**2022-23**

FS B.E. (Civil - IWM): Regular Programme

Year	**I**	**Core / ~~Elective / Foundation~~** **APH1109LCS: Applied Physics Laboratory Practical**	**Credits / Hours per week**	**02**
Semester	**I**	Year of Introduction: ~~2007~~ Year of Syllabus Revision~~: 2016~~	**Maximum Marks / Grade**	**50**
Mode of Transaction		Laboratory Experiments, discussion and viva		

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	Hours	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	**Microscope: -** To determine the average separation between consecutive wires of a given grid using travelling Microscope**.**	**02**	**1,2**	CO1, CO2	PSO1, PSO2	SD	G	PE
2	**Telescope: -** To determine the resolving power of given Telescope using Releigh criteria of resolution	**02**	**2**	CO1, CO2	PSO1, PSO2	SD	G	PE
3	**Frequency of AC Mains:** To determine the frequency of A. C. Mains.	**02**	**2,3**	CO3, CO4	PSO1, PSO2	SD	G	PE

4	**Sound Waves**: - to determine the velocity of sound wave in air using resonance	**02**	**3,4**	CO4	PSO1, PSO3	SD	G	PE
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.	**02**	**2,3**	CO1, CO2	PSO1.PSO4	SD	G	PE
6	**Solar Cell:** Study of I-V characteristics and determine the various parameter of given solar cell.	**02**	**2,3**	CO4	PSO1, PSO3	SD	G	PE
7	**Laser Parameters:** To determine the full angular divergence of the given gas laser**.**	**02**	**3,4**	CO4	PSO1, PSO3	SD	G	PE
8	**Wavelength of Laser:-** To determine the wavelength of the given laser source using diffraction	**02**	**3,4**	CO4	PSO1, PSO3	SD	G	PE
9	**Temperature Sensor:** to study the nature of different temperature (NTC/PTC//Pt-100)	**02**	**4,5**	CO1	PSO1, PSO3	SD	G	PE
10	**Young's Modulus**: to determine the Young's Modulus of a given object.	**02**	**4,6**	CO1	PSO1, PSO3	SD	G	PE

References

1	Engineering Physics: by R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications (P) Ltd. 8th Edition.
2	Fundamentals of Physics: by D. Halliday, R Resnick and J. Walker, Asian Books Pvt. Ltd. 8th Edition
3	Practical Physics, C.L. Arora S Chand Publications

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Applied Mathematics**	**Academic Year**	**2022-23**

B.E.-I (Civil / Civil - IWM)

Year	**I**	**Core / ~~Elective / Foundation~~** **AMT1106CS: APPLIED MATHEMATICS-I**	**Credits / Hours per week**	**04 Hours (3L+1T) &** **04 Credits**
Semester	**I**	Year of Introduction: 2010 Year of Syllabus Revision: 2022	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lecture		

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 1st 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 solution.

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreurship (Ent)/ Skill Development (SD)	Relevace to Local (L)/ National (N)/Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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	8	16.67	1,2,3,5	CO1		Emp, SD	G	PE
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, Maclauarin's & Taylor's expansion with reminder form, Indeterminate forms L'Hospital's rule	8	16.67	1,2,3,4	CO2				
3	**Complex Numbers:** Complex numbers & their geometrical representation, Complex numbers in polar form, Demoivre's theorem and its applications, Exponential, logarithmic, trigonometric & hyperbolic functions.	8	16.67	1,2,3,4	CO3				
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.	8	16.67	1,2,3,5	CO4 CO5 CO9				
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	10	20.83	1,2,3,5	CO6 CO7 CO8 CO9				
6	Bessel and Legendre's equations, Properties of Bessel functions Introduction to Legendre polynomials	06	12.5	1,4,5	CO10				

Reference Books		
1.	Erwin Kreyszing :	Advanced Engineering Mathematics, (6th edition) Johnwilley&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.

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Mechanical Engineering.**	**Academic Year**	**2022-2023**

B. E. (Mechanical Engineering): Regular Programme

Year	**I**	**Core / ~~Elective / Foundation~~** **MEC 1106CS: Engineering Drawing**	**Credits / Hours per week**	**03/ Lectures: 03 (hr)** **02/ Practical/Lab: 04 (hrs)**
Semester	**I (in All branched of engineering) /II in Mechanical Engineering**	Year of Introduction: Year of Syllabus Revision: 2021-2022	**Maximum Marks / Grade**	**Theory: 100** **PR/TW/VIVA: 50**
Mode of Transaction: Lectures and Practical/Laboratory teaching				

Course Outcome (CO) MEC 1106CS

- 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**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional (R)/Global (G)	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

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	02	04	1, 2, 6	CO3	PO1			
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	06	12	1,2,6	CO5	PO2			
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	08	17	3, 4, 6	CO4	PO3			
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	08	17	1, 2, 4	CO4	PO3, PO4			
5	Orthographic projection Principles and Methods of projection, First angle projection, Third angle projection, half and full sectional views	08	17	2, 3, 5	CO2	PO5			
6	Isometric Projections: Isometric axes, lines and planes, construction of isometric scale, isometric view and isometric projection	08	17	2, 4, 5	CO2	PO6			
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	08	17						
Experiments (MEC1106LCS)									
1.	Lines, lettering and dimensioning	12	18	1,2	CO1	PO1			
2.	Engineering Curves	08	12	1, 2 ,6	CO3	PO1			
3.	Orthographic projection	10	15	2,3,5	CO2	PO5			
4.	Isometric projection	08	12	2,4,5	CO2	PO6			
5.	Projection of Lines	08	12	3,4,6	CO4	PO3			
6.	Projection of planes	08	12	1,2,4	CO4	PO4			
7.	Projection and Section of Solids	10	15	1,2,6	CO5	PO2			
Reference Books									
1.	Bhatt, N.D., ‘Engineering Drawing’,								
2.	Shah, P. J., ‘Engineering Drawing’,								

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Program Name: B.E. (Civil-IWM)

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering by using tools and methodologies to provide application-oriented solutions.

PSO2 Analyze and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable.

Syllabus of Courses

<table>
<tr><td></td><td colspan="2">The Maharaja Sayajirao University of Baroda
Faculty Technology and Engineering
Department of Civil Engineering</td><td>Academic Year</td><td>2022-23</td></tr>
<tr><td colspan="5">B. E. ((Civil, Mech., Elec., Chem., Met. & Mat Sci., Electronics, Civil - IWM, Comp. Sc. & Engg., Text.Engg., Text.Tech, Text. Processing..)
: Regular Program</td></tr>
<tr><td>Year</td><td>I</td><td>Core / ~~Elective / Foundation~~
CVL 1108CS: FUNDAMENTALS OF CIVIL and ENVIRONMENTAL ENGINEERING (REVISED) (CVL1108CS)</td><td>Credits / Hours per week</td><td>04/04</td></tr>
<tr><td>Semester</td><td>I</td><td>Year of Introduction: 2018
Year of Syllabus Revision: 2022-23</td><td>Maximum Marks / Grade</td><td>100</td></tr>
<tr><td colspan="2">Mode of Transaction</td><td>Lectures: 3 Tutorial :1</td><td></td><td></td></tr>
<tr><td colspan="5">Course Outcome (CO) CVL1108CS
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</td></tr>
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Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics
									(PE)
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.	12 hrs	25	2,3	CO1	PSO2	(Emp), (Ent), (SD)	(L), (N), (R), (G)	(ES), (PE)
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.	12 hrs	25	2,3	CO2	PSO2			

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.	14 hrs	30	2, 3, 4, 5	CO3	PSO1 PSO2			
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.	10 hrs	20	1, 2, 3	CO4	PSO1 PSO2			

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	Academic Year	2022-23

B. E. (Civil, Mech., Elec., Chem., Met. & Mat Sci., Electronics, Civil - IWM, Comp. Sc. & Engg., Text.Engg., Text.Tech, Text. Processing.)

: Regular Program

Year	**I**	**Core / ~~Elective / Foundation~~** **CVL 1108LCS: FUNDAMENTALS OF CIVIL and ENVIRONMENTAL ENGINEERING (REVISED) : Field Practical (CVL1108LCS)**	**Credits / Hours per week**	**02/02**
Semester	**I**	Year of Introduction: 2018 Year of Syllabus Revision: 2022-23	**Maximum Marks / Grade**	**50**

Course Outcome (CO) CVL1108LCS

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

Mode of Transaction	Practical's, discussion and viva	**PSO1 is common for all experiments**	

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Conventional signs and symbols, scale, topographic-sheet	2	CVL1104L	1,2,3	CO3	PSO1
2	Linear measurements: tape, ranging, offsets	4	CVL1104L	2,3	CO3	PSO1
3	Compass: Introduction, Bearings	2	CVL1104L	2,3,4	CO3	PSO1
4	Auto level: Introduction, HI, Rise and fall	6	CVL1104L	2,3,4,5	CO3	PSO1
5	GPS : Introduction, and demonstration	2	CVL1104L	2,3,4	CO3	PSO1
6	Theodolite and Total Station demonstration	6	CVL1104L	2,3,4,5	CO3	PSO1
7	Any other term-work based on syllabus	2	CVL1104L	1,2	CO1 CO4	PSO1, PSO2

Bloom's Taxonomy Levels:
1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B E (Mechanical Engineering)
Programme Outcomes(POs)

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

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

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

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

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

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

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

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

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

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

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

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

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Mechanical Engineering**	**Academic Year**	**2022-23**
B. E. (Mechanical Engineering): Regular Programme **Workshop Practices (MEC111LCS)**			
Year	**I (ALL BRANCHES)**	**Core Workshop Practice**	**Credits / Hours per week**	**Lectures: 00** **Practical-: 04**
Semester	**I**	Year of Introduction: 1960 Year of Syllabus Revision:2021	**Maximum Marks / Grade**	**Theory: NILL** **PR/TW/VIVA: 100**
Mode of Transaction: Lectures and Practical				

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	**Introduction to workshop facility:** Introduction to different shops of the workshop, general safety guidelines, familiarization with workshop facility	04	7	1,2,3, 4,5,6	Co1	Po 2,3,4	Emp, Ent, SD	L,N,R,G	G, ES, HV, PE
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.	08	14	1,2,3, 4,5,6	Co2,3	Po 2,3,4,5			
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.	08	13	1,2,3, 4,5,6	Co2,3	Po 2,3,4,5			
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.	08	13	1,2,3, 4,5,6	Co2,3	Po 2,3,4,5			
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.	12	20	1,2,3, 4,5,6	Co2, 4	Po 2,3,4,5,9			
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	08	13	1,2,3, 4,5,6	Co5	Po 2,3,4,5			

7	**Moulding Practice:** Introduction to different tools of moulding shop, Demonstration of moulding process, Preparation of mould assembly as per pattern.	08	13	1,2,3, 4,5,6	Co2,3	Po 2,3,4,5			
8	**Press Working:** Demonstration of press working operations like blanking, punching, piercing etc.	04	7	1,2,3, 4,5,6	Co7	Po 2,3,4,5			
		60	100						
	Course Outcome (CO) MEC 1102 1102.01 Understand importance of workshop practices along with safety precautions in different shops. 1102.02 Understand the basic operations of carpentry, fitting, smithy and molding shop by using various marking, measuring, cutting and inspection tools. 1102.03 Hands on practice and job making in carpentry, fitting, smithy and molding shop 1102.04 Understand various manufacturing operations in machine shop 1102.05 Understand different types of metal joining processes and perform basic operations of welding shop 1102.06 Perform basic operations on lathe and shaping machine in machine shop. 1102.07 Understand the basic operations of press working								

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

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: BE (Civil - IWM) Regular Programme

Programme Specific Outcome (PSO) Graduate will be able to,

PSO1 Apply knowledge of material sciences, metallurgical engineering and material technology in identifying and providing appropriate solution for metallurgical and materials industries.
PSO2 Design, optimize various metallurgical and materials engineering processes to develop quality and cost effective products
PSO3 Build successful career in design, development, manufacturing and process control of metallurgical and materials engineering industries.
PSO4 Acquire their knowledge in the domain of different metal and materials working and testing to undertake the challenges of the related industries
PSO5 Manage proficiency and necessary skills to take up entrepreneurial Venture.
PSO6 Serve to the needs of metallurgical and materials engineering Industry and the Nation.
PSO7 Get platform to design and create prototypes with changing demands of the metallurgical and materials engineering fields through various research and development.
PSO8 Develop the right attitude in the metallurgical and materials engineering field so that they become an employable or to pursue higher studies

Syllabus of Courses

<table>
<tr><td colspan="2">The Maharaja Sayajirao University of Baroda
Faculty Technology and Engineering
Department of Metallurgical & Materials Engineering</td><td>Academic Year</td><td>2022-23</td></tr>
<tr><td colspan="4">Common Subject for All Branch [F.S. B.E. I(C, M, E, Ch., Met & Mats. IWM, Comp. Sci., Text. Engg.)]</td></tr>
<tr><td>Year</td><td>I</td><td>Core / <s>Elective / Foundation</s>
Code: MET 1105CS
Subject: Materials Science</td><td>Credits / Hours per week</td><td>04 (Theory)</td></tr>
<tr><td>Semester</td><td>I</td><td>Year of Introduction:
Year of Syllabus Revision:</td><td>Maximum Marks / Grade</td><td>100 (Theory)</td></tr>
<tr><td colspan="2">Mode of Transaction</td><td>Lectures and Tutorials</td><td></td><td></td></tr>
<tr><td colspan="4">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</td></tr>
</table>

Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	**The basics of materials** Materials classifications, basis for solid materials or arrogation of atoms, aggregation with metallic bonding, metal crystal structures, density of crystal, atomic packing factor, co-ordination nos., numerical	06	12	1/2/3/ 4/5	CO1	1,2	SD	G	ES
2	**A system for navigating crystals** Miller Indices, determination of crystal lattice, crystallographic direction and planes.	04	8	1/2/3	CO2	1,2,3			
3	**Imperfection in solids** Classification of defects/imperfections, Point defects, line defects, area defects, volume defects and amorphism	04	8	1/2	CO3	2,4,5			
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	06	12	1/2	CO4	1,2,6			
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	08	16	1/2/3/ 4/5	CO5	1,2,3, 4			
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 Harding, grain refinement	06	12	1/2/3/ 4	CO6	2,3,5, 7			

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	05	10	1/2	CO7	5,6,7, 8			
8	**Composite Materials** Classification of composite materials, Role of the reinforcement and matrix phases in composites, Nano composites	05	10	1/2	CO8	5,6			
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	06	12	1/2/3/ 4	CO9	7,8			
	TOTAL	**50 Hours**	**100%**						

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)

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application-oriented solutions.

PSO 2 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable.

Syllabus of Courses

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**		**Academic Year**	**2022-23**
B.E - I (Civil-IWM): Regular Programme			
Year	**I**	**Core ~~/ Elective~~ / ~~Foundation~~** **CVL 1208CS: Surveying-I**	**Credits / Hours per week**	**4 / 3L + 1T (4 hrs)**
Semester	**II**	Year of Introduction: Year of Syllabus Revision:	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) CVL 1208CS

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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance Local (L)/ /National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Different methods of leveling: LS and CS, Contouring; sources of error; curvature and refraction correction.	08	15	2,3	1	PSO1	Employability (Emp)/	Global (G)	PE

2	Plane table and accessories: Adjustments, Different plotting methods, errors in plane table survey, two point and three point problem.	04	07	2,3	1,2	PSO1	Entrepreneurship (Ent)/ Skill Development (SD)		
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.	10	19	2,3,4	1,2	PSO1			
4	Study of Transit and optical Theodolite; Adjustment; Transit survey; Latitude and departure; Gale"s Traverse table; Numerical based on above.	08	15	2,3,4	1,2,3	PSO1, PSO2			
5	Tacheometry: Principle; Determination of constants; computation of distance and levels; Inclined sights; and Tangential tacheometry.	09	17	2,3,4	1,2,3	PSO1, PSO2			
6	Total station: Introduction, Components used in Total station, Types of Total station survey , Advantages and Disadvantages of Total station surveying.	06	12	2, 3,4	1,2,3	PSO1, PSO2	Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Global (G)	
7	Hydrography: Introduction, Purposes, Control points, Sounding, Instruments & methods of locating soundings.	05	09	2,3	2,3	PSO1,			
8	Setting out works: Building , Culvert, Bridge, Tunnel	05	09	2,3	1,2,3	PSO1, PSO2			

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	Academic Year	2022-23

B.E - I (Civil - IWM): Regular Programme

Year	I	Core / ~~Elective~~ / ~~Foundation~~ **CVL 1208LCS: Surveying-I Practical**	Credits / Hours per week	Credit – 1 / 02 (hrs.)
Semester	II	Year of Introduction: Year of Syllabus Revision:	Maximum Marks / Grade	50
Mode of Transaction		Termwork		

No.	Practical	Course Code	BT Level	CO	PSO
1	Theodolite Introduction	CVL 1202L	1,2,3	CO1, CO2	PSO1
2	Measurement of angles	CVL 1202L	2,3,4	CO2, CO3	PSO1
3	Lineout of building by manual method	CVL 1202L	2,3,4	CO2, CO3	PSO1, PSO2
4	Lineout of building by Instrument (Theodolite)	CVL 1202L	2,3,4	CO2, CO3	PSO1, PSO2
5	Road Profile survey	CVL 1202L	2,3,4	CO2, CO3	PSO1, PSO2
6	Road profile sheet preparation	CVL 1202L	2,3,4	CO2, CO3	PSO1, PSO2
7	Digital planimeter	CVL 1202L	3,4	CO2, CO3	PSO1
8	Introduction Total station	CVL 1202L	3,4,5	CO1	PSO1
9	Station set up, Angle measurement, Height measurement with Total station, Traverse survey with Total station	CVL 1202L	3,4,5	CO2, CO3	PSO1, PSO2

Programme Name: S.S. B E – I All branches of Engineering

Bloom's Taxonomy (BT Levels): 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Syllabus of Course

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering**		**Academic Year**	**2022-23**
FS/SS B E-I/B E-II (All branches of 4-year Engineering programme)			
Year	**I**	**Core** **COMMUNICATION SKILLS** **(ENG1002CS)**	**Credits / Hours per week**	**2.5/ 2L+1P**
Semester	**II**		**Maximum Marks / Grade**	**50+50=150**
Mode of Transaction		Lectures and Practicals		

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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurs hip (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

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.	04	15%	1,2,	1	1	**SD**	**G**	**ES**
2	Listening Ability, Hearing and Listening, Types of Listening, Barriers to Effective Listening, Traits of a Good Listener.	04	15%	1,2,3	2	1	**SD**	**G**	**ES**
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.	10	40%	1,2,3	3,4	1	**SD**	**G**	**ES**
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	04	15%	1,2,4	4	1	**SD**	**G**	**ES**
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	04	15%	1,2,3	3,4	1	**SD**	**G**	**ES**
T.W./ Pr.	Term work / Practicals shall be based on above syllabus.								

REFERENCES	
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

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B.E. (Civil-IWM)

Programme Specific Outcome (PSO)

PSO1 ~~Demonstrate knowledge and understanding of principles of Civil Engineering by using tools and methodologies to provide application oriented solutions.~~ *Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.*

PSO2 ~~Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and environment friendly.~~ *Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable*

~~PSO3 Identify and recommend materials and technologies for effective and sustainable solutions.~~

~~PSO4 Apply knowledge of mathematics, science and basic engineering fundamentals to solve problems of Civil Engineering.~~

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Applied Mechanics**		**Academic Year**	**2022-23**
B.E. (Civil - IWM) : Regular Programme				
Year	**I**	~~**Core / Elective**~~ **/ Foundation** **APM 1206CS :APPLIED MECHANICS**	**Credits / Hours per week**	***04*/04**
Semester	**II**	Year of Introduction: 1984 Year of Syllabus Revision: 2010, 2022	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorial (3+1)		

Course Outcome (CO) APM12XX

CO1: ~~Student will learn different various types of forces and force system. Effect of Force system and Equilibrium condition the factor affecting the Equilibrium.~~ *Understand various types of forces, force systems and equilibrium conditions*

CO2: ~~Understanding of the axial forces in Plane and Space truss. Analysis of problems by analytical and Graphical Method.~~ *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: ~~Student will be able to learn of the Center of Gravity and Moment of Inertia of any type of the section of the body.~~ *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*

~~CO4: Refreshes the basics of theory of machine.~~

~~CO5: Analysis and evaluation of number of Teeth on the wheel and its rotation in the body.~~

~~CO6: Refreshes the effects on body when kinetics and kinematics forces acting on the body. Analysis of D'Alembert's principle, work, power and energy. Impulse and momentum, Equations of motion, Translation, Fixed axis rotation and Problems involving friction.~~

~~CO7: student will understand basic stress system and elastic constants in brittle and ductile materials.~~

~~CO8: Application of frictional force on inclined planes etc. by applying static conditions of equilibrium.~~

1	2	3	4	5	6	7	8	9	10
Unit No.	**Topic/Unit**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional (R)/Global (G) developmental needs	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics(PE)
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.	15	25	1,2,3,4,5	CO1 CO2	~~PSO3,~~ ~~PSO4~~ *PSO 1*	SD, EMP	G	ES

	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.	15	25	1,2,4	~~CO3, CO8~~ *CO1, CO2*	~~PSO3,~~ ~~PSO4~~ *PSO 1*			
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.	15	25	2,3,4,5	~~CO4,CO5~~ *CO1, CO2*	~~PSO3,~~ ~~PSO4~~ *PSO 1*			
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.	15	25	1,2,3,4,5	~~CO6, CO7~~ *CO1, CO3*	~~PSO3,~~ ~~PSO4~~ *PSO 1*			
Reference Books									

1.	Applied Mechanics by S. B. Junnarkar and H. J. Shah, Charotar Pub.
2.	Engineering Mechanics byMerium 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 Applied Mechanics**	**Academic Year**	**2022-23**

B.E. (CIVIL): Regular Programme

Year	**I**	~~**Core / Elective**~~ **/ Foundation** **APM 1206LCS :APPLIED MECHANICS**	**Credits / Hours per week**	***01/~~03~~02***
Semester	**II**	Year of Introduction: 1984 Year of Syllabus Revision: 2010, 2022	**Maximum Marks / Grade**	**50**
Mode of Transaction		Laboratory Experiments, *Assignments*, discussion and viva	**is common for all experiments**	

No.	**EXPERIMENT**	**Contact hours**	**% weightage**	**BT Level**	**CO**	**PSO**
1	~~LAW OF PARALLELOGRAM OF FORCES~~ *EXPERIMENT ON TRUSS*	~~3~~*2*	~~6~~*7*	2,3	~~CO1~~*CO2*	~~PSO3, PSO4~~ *PS01*
2	LAW OF POLYGON	2	~~4.~~*7*	2,3	~~CO2~~ *CO1*	~~PSO3, PSO4~~ *PS01*
3	SIMPLE BEAM	2	~~4.~~*7*	2,3	CO2	~~PSO3, PSO4~~ *PS01*
4	JIB CRANE	2	~~4.~~*7*	2	~~CO4~~ *CO1*	~~PSO3, PSO4~~ *PS01*
5	THEORY OF LIFTING MACHINE	~~3~~*2*	~~6.~~*7*	2,3	~~CO4~~ *CO2*	~~PSO3, PSO4~~ *PS01*
6	ROPE AND PULLEY BLOCK	2	~~4.~~*7*	2,3	~~CO4~~ *CO2*	~~PSO3, PSO4~~ *PS01*
7	SCREW JACK	2	~~4.~~*7*	2,3	~~CO4~~ *CO2*	~~PSO3, PSO4~~ *PS01*
8	DIFFERINTIAL AXLE	2	~~4.~~*6*	2,3	~~CO5~~ *CO2*	~~PSO3, PSO4~~ *PS01*
9	WORM AND WORM WHEEL	2	~~4.~~*6*	2,3	~~CO3~~ *CO2*	~~PSO3, PSO4~~ *PS01*
10	MOMENT OF INERTIA OF FLY WHEEL	2	~~4.~~*6*	2,3	~~CO3~~ *CO2*	~~PSO3, PSO4~~ *PS01*
11	RADIUS OF GYRATION OF COMPOUND PENDULUM	2	~~4.~~*6*	2,3	~~CO3~~ *CO2*	~~PSO3, PSO4~~ *PS01*
12	*ASSIGNMENTS*	*08*	*27*	*1,2,3,4,5*	*CO1,CO2,CO3*	*PSO1*

~~**GRAPHICS**~~

12	COPLANAR CONCURRENT FORCE SYSTEM 1	3	6.66	2	CO1	PSO3 4
13	COPLANAR CONCURRENT FORCE SYSTEM 2	2	4.44	2	CO1	PSO3 4
14	COPLANAR NON CONCURRENT FORCE SYSTEM 1	2	4.44	2	CO1	PSO3 4
15	COPLANAR NON CONCURRENT FORCE SYSTEM 2	2	4.44	2	CO1	PSO3 4
16	REACTION OF BEAMS 1	2	4.44	2	CO2	PSO3 4
17	REACTION OF BEAMS 2	2	4.44	2	CO2	PSO3 4
18	ANALYSIS OF ROOF TRUSS FOR SIMPLY SUPPORTED	2	4.44	2	CO1	PSO3 4
19	ANALYSIS OF ROOF TRUSS FOR CANTILEVER	2	4.44	2	CO1	PSO3 4
20	WEDGE BLOCK FRICTION	2	4.44	2	CO8	PSO3 4
21	CENTROID OF PLANE LAMINA	2	4.44	2	CO3	PSO3 4

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Mechanical Engineering**	**Academic Year**	**2022-23**

B. E. (Civil - IWM): Regular Programme

Year	**I**	**Core / ~~Elective / Foundation~~** **MEC 1213CS: Fundamental of Mechanical Engineering**	**Credits / Hours per week**	**Credits : 4** **Lectures (04+ 00)hr**
Semester	**II**	Year of Introduction: 2022-23 Year of Syllabus Revision:	**Maximum Marks / Grade**	**100**
Mode of Transaction Lectures				

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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	08	15	1, 2, 3,4	CO1	PO1, PO12, PO5	SD	G	PE

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.	10	25	2, 3,4	CO2	PO1, PO2, PO3			
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.	11	21	1,2,4	CO3	PO3, PO5			
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.	08	13	1, 4,5	CO4	PO1, PO3, PO4			
5	Couplings, Clutches and Brakes: Construction and applications of Couplings, Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc)	07	13	1, 4,5	CO5	PO1, PO4, PO5, PO12			
6	Transmission of Motion and Power: Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive.	08	13	1,2, 3, 6	CO6	PO1, PO2, PO3			
		52	100						

Course Outcome (CO) MEC

CO.01 Understanding of properties of gas
CO.02 Understanding of properties of steam .
CO.03 Understand of basics of boiler and steam engine.
CO.04 Understand basic of IC engine its thermodynamic cycles.
CO.05 Understand air compressors.
CO.06 Understanding of working cycles of refrigeration and air conditioning system.
CO.07 Understanding of coupling , clutch and breaks.
CO.08 Understand basic of power transmission system.

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

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B.E.-I (Civil / Civil-IWM)

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Physics		**Academic Year**	**2022-23**
B.E.-I (Civil / Civil-IWM): Regular Programme				
Year	**I**	**Core / ~~Elective / Foundation~~ AMT1212CS: Applied Mathematics - II**	**Credits / Hours per week**	**03 Hours (2L+1T) & 03 Credits**
Semester	**II**	Year of Introduction: 2010 Year of Syllabus Revision: 2022	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures		

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**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Element s of** Employa bility (Emp)/ Entrepre neurship (Ent)/ Skill Develop ment (SD)	**Relev an ce to** Local (L)/ Nation al (N)/ Regiona l (R)/Glo b al (G)	**Relation to** Gender (G), Environ ment and Sustainab ility (ES), Human Values (HV)and Professional Ethics(PE)

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	12	33.34	1,2,3	CO1, CO3, CO4		Emp / Ent	N / G	PE
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	06	16.67	1,2,3	CO2				
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,	12	33.33	2, 3, 4,5	CO6	12			
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.	06	16.66	1, 2, 3,5	CO5				

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.

Programme Name: B E Civil & BE (Civil- IWM)

Bloom's Taxonomy (BT Levels): 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil engineering and relevant basic sciences by using tools and methodologies to provide application- oriented solutions.

PSO2 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**		**Academic Year**	**2023-24**
B E (Civil – IWM): Regular Programme				
Year	**II**	**Core / ~~Elective / Foundation~~** **CVL 1306CS: BUILDING DRAWING AND DESIGN**	**Credits / Hours per week**	**3L+ 1T**
Semester	**I**	Year of Introduction: **2022** Year of Syllabus Revision:	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures, Tutorials and Drawing		
Course Outcome (CO) CVL 1201 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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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.	07	13%	2,3	CO1	PSO1	**(Emp), (Ent), (SD)**	**(L), (N),(R), (G)**	**(ES), (PE)**
2	Introduction to basic principles of planning, orientation, aspect, prospect, furniture requirements, roominess, grouping, circulation, privacy, climate, economy, sanitation considerations etc.	07	13%	2,3	CO2	PSO1			
3	Preparation of drawing based on plan: Complete drawing along with site plan, elevation, section. Working drawing set. Staircase, design of Dog-legged staircase,	07	13%	6	CO6	PSO2			
4	Introduction to AutoCAD software, Different commands and their functions. Drawing using AutoCAD software.	06	13%	2,3	CO6	PSO2			
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.	08	15%	2	CO3	PSO1			
6	Slum: definition, causes, effects, precautions and improvement schemes.	03	6%	2	CO5	PSO1			
7	Public Building: Types, planning criterias of various types of public buildings, design of public buildings, principles of composition.	08	15%	2,3,6	CO2 CO6	PSO1			
8	Design of sun shading system, Overhang, louvers, Application of solar data to design louver system.	06	12%	3,4	CO4	PSO1 PSO2			

REFERENCES

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.

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering	Academic Year	2023-24

B E (Civil – IWM) : Regular Program

Year	**II**	**Core / ~~Elective / Foundation~~** **CVL 1306LCS: BUILDING DRAWING AND DESIGN**	**Credits / Hours per week**	**02**
Semester	**I**	Year of Introduction: **2022** Year of Syllabus Revision:	**Maximum Marks / Grade**	**50**
Mode of Transaction		Drawing, Term work and viva		

.

No.	Drawing, Term work	Contact Hours	Course Code	BT Level	CO	PSO
1	One Drawing sheet of residential building	4	CVL12XXL	1,2,3	CO2 CO6	PSO2
2	Measured Drawing of Existing Building	8	CVL 12XXL	2,3,4,5,6	CO1 CO6	PSO1, PSO2
3	Planning and Design of Residential building	6	CVL12XXL	2,3,4,5,6	CO2 CO6	PSO2
4	Design of Public Buildings	8	CVL12XXL	3,4,6	CO6	PSO2

Programme Name: B E Civil & (Civil -IWM)

Bloom's Taxonomy (BT Levels): 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.

PSO2 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**		**Academic Year**	**2023-24**
B E (Civil – IWM): Regular Programme				
Year	**II**	**Core / ~~Elective / Foundation~~** **CVL1307CS : HYDRAULIC ENGINEERING**	**Credits / Hours per week**	**5 / 4L+ 0T+ 2P**
Semester	**I**		**Maximum Marks / Grade**	**100+50=150**
Mode of Transaction		Lectures, Tutorials and Practical's		

Course Outcome (CO) CVL HYDRAULIC ENGINEERING

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	Contact Hours	Weigh tage (%)	BT Lev el	CO	PSO	Elements of Employabi li ty (Emp)/ Entreprene u rship (Ent)/ Skill Develop me nt (SD)	Relevance to Local (L)/ National (N)/ Regional(R) / Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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.**	**06**	**11.5 %**	**1,2**	**1**	**1**	**SD**	**G**	**ES/PE**
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**	**06**	**11.5 %**	**1,2**	**1,3**	**1**	**SD**	**G**	**ES/PE**

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.**	**14**	**27%**	**1,2,3**	**1,3**	**1,2**	**EMP/ENT**	**G**	**ES/PE**
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.**	**10**	**19%**	**1,2,3**	**1,3**	**1,2**	**EMP/ENT**	**G**	**ES/PE**
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.**	**03**	**6 %**	**2,3**	**1,3**	**1,2**	**EMP/ENT**	**G**	**ES/PE**
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.**	**06**	**11.5 %**	**2,3**	**4**	**1,2**	**EMP**	**G**	**ES/PE**

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.**	**07**	**13.5 %**	**1,2,3**	**4**	**1,2**	**EMP**	**G**	**ES/PE**
T.W./ Pr.	Termwork / Practicals shall be based on above syllabus.								
REFERENCES									
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.								

Programme Name: B. E. (Civil - IWM)

Bloom's Taxonomy (BT Levels): 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**		**Academic Year**	**2023-24**
B E (Civil – IWM): Regular Program				
Year	**II**	**Core / ~~Elective / Foundation~~** **Hydraulic Engineering Practical / Termwork including Viva**	**Credits / Hours per week**	**02P**
Semester	**I**		**Maximum Marks / Grade**	**50**

Course Outcome (CO) CVL 1307LCS

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

Mode of Transaction	Field Practical's, discussion and viva	**PSO1 is common for all experiments**				
No.	Term-work / Field Practical shall be based on above syllabus	**Contact Hours**	**Course Code**	**BT Level**	**CO**	**PSO**
1	Verification Of Law Of Hydrostatic Pressure	02hours	CVL	2,3,4,5	CO1	PSO1, PSO2
2	Determination Of The Coefficient For A Circular Orifice	04 hours	CVL	2,3,4,5	CO3, CO6	PSO1
3	Calibration Of A "V" Notch	02 hours	CVL	2,3,4,5	CO6	PSO1
4	Experimental Proof Of Bernoulli's Theorem	02hours	CVL	2,3,4,5	CO3	PSO1
5	Calibration Of Venturimeter	02hours	CVL	2,3,4,5	CO3, CO6	PSO1
6	Verification Of Reynold's Number For Laminar-Turbulent Flow	02hours	CVL	2,3,4,5	CO4	PSO1

7	Verification Of Relationship Between Energy Loss & Velocity And Determination Of Friction Factor For A Pipe	02hours	CVL	2,3,4,5	CO4, CO5	PSO1, PSO2
8	Currentmeter	04 hours	CVL	2,3,4,5	CO6	PSO1
9	Rugosity Coefficient	02hours	CVL	2,3,4,5	CO6	PSO1, PSO2
10	Pitot Tube	02hours	CVL	2,3,4,5	CO3, CO6	PSO1
11	Orificemeter	02hours	CVL	2,3,4,5	CO3, CO6	PSO1

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B.E. (Civil-IWM)

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.

PSO2 Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable

Syllabus of Courses

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Applied Mechanics**		**Academic Year**	**2023-24**
B E (Civil – IWM): Regular Programme			
Year	**II**	~~**Core / Elective**~~ **/ Foundation** **APM 1309CS : MECHANICS OF MATERIALS**	**Credits / Hours per week**	**04**
Semester	**I**	Year of Introduction: 2023 Year of Syllabus Revision:	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorial		

Course Outcome (CO) APM 1309CS

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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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**	**16**	**30**	**1,2,3,4 ,5**	**CO1, CO2,**	**PSO1, PSO2**	**SD**	**G**	**ES**

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.**	**16**	**30**	**2,3,4, 5**	**CO3, CO4**	**PSO1, PSO2**			
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.**	**10**	**20**	**2,3,4, 5**	**CO5**	**PSO1, PSO2**			
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.**	**10**	**20**	**2,3,4, 5**	**CO6**	**PSO1, PSO2**			

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 Faculty Technology and Engineering Department of Applied Mechanics	Academic Year	2023-24

B E (Civil – IWM): Regular Programme

Year	II	~~Core / Elective~~ / Foundation APM 1309LCS: MECHANICS OF MATERIALS	Credits / Hours per week	02
Semester	I	Year of Introduction: 2023 Year of Syllabus Revision:	Maximum Marks / Grade	50
Mode of Transaction		Laboratory Experiments, Discussion and Viva		

No.	EXPERIMENT	Contact Hours	% weightage	BT Level	CO	PSO
1	COPMLETE TENSILE TEST ON MILD STEEL (MS)	2	9	2,3	CO1, CO2	PSO1, PSO2
2	MODULUS OF ELASTICITY FOR MS	2	9	2,3	CO1, CO2	PSO1, PSO2
3	DIRECT SHEAR TEST ON MS	2	9	2,3	CO1, CO3	PSO1, PSO2
4	COPMRESSION TEST ON MS AND CAST IRON (CI)	2	9	2,3	CO1, CO5	PSO1, PSO2
5	COMPRESSION TEST ON TIMBER	2	9	2,3	CO1, CO5	PSO1, PSO2
6	IZOD IMPACT TEST ON CI, MS AND BRASS	2	9	2,3	CO1, CO4	PSO1, PSO2
7	HARDNESS TEST ON MS, CI AND BRASS	2	9	2,3	CO1	PSO1, PSO2
8	TORSION TEST ON MS AND CI	2	9	2,3	CO1, CO6	PSO1, PSO2
9	MODULUS OF RUPTURE OF TIMBER	2	9	2,3	CO1, CO2	PSO1, PSO2
10	MODULUS OF ELSTICITY OF TIMBER	2	9	2,3	CO1, CO2	PSO1, PSO2
11	TUTORIALS	6	10	2,3	CO1, CO2	PSO1, PSO2

POs

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1: Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.
PSO2: Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

Programme Name: B E Civil & Civil - IWM

Bloom's Taxonomy (BT Levels): 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering by using tools and methodologies to provide application oriented solutions. PSO2 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable.

Syllabus of Courses

<table>
<tr><td colspan="2">The Maharaja Sayajirao University of Baroda
Faculty Technology and Engineering
Department of Civil Engineering</td><td>Academic Year</td><td>Year of implementation: 2023-24</td></tr>
<tr><td colspan="4">B E (Civil – IWM): Regular Program</td></tr>
<tr><td>Year</td><td>II</td><td>Core / ~~Elective / Foundation~~
ELE 1320CS Electrical Engineering Fundamentals</td><td>Credits / Hours per week</td><td>04</td></tr>
<tr><td>Semester</td><td>I</td><td>Year of Introduction: 2023
Year of Syllabus Revision:</td><td>Maximum Marks / Grade</td><td>100</td></tr>
<tr><td colspan="2">Mode of Transaction</td><td>Lectures and Laboratory</td><td></td><td></td></tr>
<tr><td colspan="4">Course Outcome (CO) ELExxxx (New Syllabus)
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.</td></tr>
</table>

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurs hip (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Fundamental concepts of DC circuits, analysis of series, parallel and series-parallel circuits with DC excitations, fundamentals of magnetic circuits and electromagnetic induction	10	20	5,5	CO 1, CO 2	--	**(SD)**	**(G)**	**(PE)**
2	Fundamentals of AC circuits, analysis of single-phase ac circuits consisting of R, L, C and their combinations, analysis of polyphase circuits.	10	20	5,5	CO 4, CO 5	--			
3	Working principle of DC machine as a generator and a motor; types and constructional features, characteristics of DC machines, speed control and applications.	**10**	**20**	**5,5**	CO 1, CO 2	**--**			
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.	**10**	**20**	**5,5**	CO 4, CO 5	**--**			
5	Overview of renewable and non-renewable power sources, concept of cogeneration, and distributed generation; overview of transmission and distribution of power.	**06**	**10**	**2**	CO 3	**--**			
6	Application of electrical devices like components of LT Switchgear, types of wires, cables, earthing, measuring instruments, batteries, elementary calculations for energy consumption.	**06**	**10**	**2**	CO 6	**--**			

REFERENCES	
1.	A Textbook of Electrical Technology: Volume I,- B.L.Theraja & A.K.Theraja, S. Chand.
2.	Problems in Electrical Engineering- Parker Smith, 9th edition
3.	Basic Electrical Engineering – V.N. Mittle, 5th Edition, McGraw Hill
4.	Basic Electrical Engineering – D.P. Kothari and I.J. Nagrath, 3rd 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, 10th 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

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1	Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions
PSO2	Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**		**Academic Year**	**2023-24**

B. E. (Civil – IWM): Regular Program

Year	**II**	**Core / ~~Elective / Foundation~~** **ELE1320LCS : Electrical Engineering Fundamentals- Term work, Practical and Viva**	**Credits / Hours per week**	**02 P**
Semester	**I**	Year of Introduction: 2023 Year of Syllabus Revision:	**Maximum Marks / Grade**	**50**

Course Outcome (CO) ELE1320LCS (New Syllabus)

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.

Mode of Transaction	Practical and Viva	**PSO1 is common for all experiments**

No.	Term-work / Field Practical shall be based on above syllabus	**Contact Hours**	**Course Code**	**BT Level**	**CO**	**PSO**
1	Study of Laboratory apparatus and D.C machine.	02	ELExxxxL	5, 2	CO1 CO6	--
2	Verification of Kirchhoff's laws.	02	ELExxxxL	5,5	CO1 CO2	--
3	R – L – C Series circuit.	04	ELExxxxL	5,5	CO4 CO5	--
4	Self and mutual inductance	02	ELExxxxL	5,5	CO4 CO5	--
5	AC parallel circuit.	02	ELExxxxL	5,5	CO4 CO5	--
6	Open circuit and short circuit test on 1-phase transformer	02	ELExxxxL	5,5	CO4 CO5	--
7	Power measurement in a 3-phase circuit by two wattmeter method	02	ELExxxxL	5,5	CO4 CO5	--
8	Speed control of DC shunt motor	02	ELExxxxL	5,5	CO1 CO2	--
9	Load Test on 3 phase induction motor	02	ELExxxxL	5,5	CO4 CO5	--
10	Study of Electrical Accessories, Wiring and Earthing	06	ELExxxxL	2	CO6	--

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B.E.-II (Civil / Civil-IWM)

Programme Specific Outcome(PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.

PSO2 Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

Syllabus of Courses

The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Physics		**Academic Year**	**2023-24**
B.E.-II (Civil / Civil-IWM): Regular Programme			
Year	**II**	**Core / ~~Elective / Foundation~~ AMT1312CS: Applied Mathematics - III**	**Credits / Hours per week**	**03 Hours (2L+1T)& 03 Credits**
Semester	**I**	Year of Introduction: 2006 Year of Syllabus Revision: 2022	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lecture		

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.8

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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.	12	33.33	1,2,3	CO1 CO2, CO3	PSO1 PSO2	Emp / Ent	N / G	PE
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.	12	33.33	2,3,4,5	CO4 CO5	PSO1 PSO2			

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.	**12**	**33.33**	**2,3,4,6**	**CO6**	**PSO1** **PSO2**			

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

Programme Name: B E (Civil – IWM):

Bloom's Taxonomy (BT Levels): 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Specific Outcome(PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering by using tools and methodologies to provide application oriented solutions. PSO2 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable.

Syllabus of Courses

<table>
<tr><td colspan="2">The Maharaja Sayajirao University of Baroda
Faculty Technology and Engineering
Department of Civil Engineering</td><td>Academic Year</td><td>2023-24</td></tr>
<tr><td colspan="4">B E (Civil – IWM): Regular Program</td></tr>
<tr><td>Year</td><td>II</td><td>Core / ~~Elective / Foundation~~
CVL 1409CS SURVEYING- II</td><td>Credits / Hours per week</td><td>4L</td></tr>
<tr><td>Semester</td><td>II</td><td>Year of Introduction: 2022
Year of Syllabus Revision:</td><td>Maximum Marks / Grade</td><td>100</td></tr>
<tr><td colspan="2">Mode of Transaction</td><td>Lectures, Tutorials and Drawing</td><td></td><td></td></tr>
<tr><td colspan="4">Course Outcome (CO) CVL 1405 (New Syllabus)
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</td></tr>
</table>

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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.	04 hrs	5%	1,2,3, 4,5	CO1	PSO1	**(Emp), (Ent), (SD)**	**(L),(N),(R), (G)**	**(ES), (PE)**
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	06 hrs	10%	1,2,3, 4,5	CO1	PSO1			
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.	**04 hrs**	**10%**	**1,2,3, 4,5**	**CO1**	**PSO1**			
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.	**07 hrs**	**15%**	**2,4**	**3**	**PSO2**			
5	Photogrammetric Surveys and mapping. Aerial and terrestrial photogrammetry. Global Positioning System.	**05 hrs**	**12%**	**3,4**	**4**	**PSO1**			
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.	**10 hrs**	**25%**	**1,2,3, 4**	**CO2**	**PSO1**			

7	Remote Sensing: Introduction, Principles of Energy Interaction in atmosphere and Earth surface features. Image interpretation techniques, visual interpretation, Digital Image Processing.	**04 hrs**	**8%**	**2,3**	**5**	**PSO2**			
8	Geographical Information System- Definition of GIS, Key components of GIS, Func tions of GIS, Spatial data, Spatial Information System, Geospatial analysis, Integration of Remote Sensing and GIS, Applications in Civil Engineering.	**08 hrs**	**15%**	**3,4**	**5**	**PSO2**			

REFERENCES	
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

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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PSO1	Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions
PSO2	Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**	**Academic Year**	**2023-24**

B E (Civil – IWM): Regular Program

Year	**II**	**Core / ~~Elective / Foundation~~** **CVL 1409LCS SURVEYING- II: Field Practical, Discussion, Viva**	**Credits / Hours per week**	**02P**
Semester	**II**	Year of Introduction: 2022 Year of Syllabus Revision:	**Maximum Marks / Grade**	**50**

Course Outcome (CO) CVL 1405L (New Syllabus)

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 Photogrammetric Survey and introduction of GPS.
CO5 Introduction of G.I.S and Remote sensing. Application in engineering projects

Mode of Transaction	Field Practical's, discussion and viva	**PSO1 is common for all experiments**

No.	Term-work / Field Practical shall be based on above syllabus	**Contact Hours**	**Course Code**	**BT Level**	**CO**	**PSO**
1	Curves using non instrumental and Instrumental method with Total station	10 hours	CVL1402L	1,2,3,4	CO1	PSO1
2	Contour Survey with Total station	4 hours	CVL1402L	2,3,4	CO3	PSO1. PSO2
3	Astronomy	4 hours	CVL1402L	2,3,4	CO2	PSO1
4	Demonstration of G.I.S and mapping	4 hours	CVL1402L	2,3,4,5	CO5	PSO1. PSO2
5	Photogrammetry	4 hours	CVL1402L	1,2	CO4	PSO1, PSO2

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B.E. (Civil - IWM): Regular Programme

Programme Specific Outcome (PSO)

PSO1: Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.

PSO2: Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		**Academic Year**	**2022-23**
B E (Civil – IWM): Regular Programme				
Year	**II**	**Core CVL1410CS: Construction Technology**	**Credits / Hours per week**	**04**
Semester	**II**	Year of Introduction: 2023-24 Year of Syllabus Revision:	**Maximum Marks / Grade**	**30+70 = 100**
Mode of Transaction		Lectures and Tutorials	**04(L) + 0(T) +0 (TW)=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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R) /G lo ba l (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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**.**	**06**	**11**	**1,2**	**CO1**	**PSO 1**	**(Emp),(Ent), (SD)**	**(L),(N),(R),(G)**	**(PE)**
2	**Cofferdams -** Terminology, Types: earth fill, rock fill, Timber Crib, Sheet pile, Double wall, cellular, movable cofferdam	**02**	**4**	**2,3**	**CO1**	**PSO 1** **PSO 2**	**(Emp),(Ent),(SD)**	**(L),(N),(R),(G)**	**(PE)**
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.	**07**	**13**	**1,2**	**CO2**	**PSO 1**	**(Emp),(Ent),(SD)**	**(L),(N),(R),(G)**	**(PE)**

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	**07+07 = 14**	**27**	**1,2**	**CO3**	**PSO 1**	**(Emp),(Ent),(SD)**	**(L),(N),(R),(G)**	**(PE)**
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	**03**	**6**	**1,2**	**CO4**	**P S O 1**	**(Emp),(Ent),(SD)**	**(L),(N),(R),(G)**	**(PE)**
6	**Vertical Circulation** Stairs – Terminology, Characteristics of an Ideal Stair, Types of Stair and Staircase, staircase planning, Types of steps, elevators and escalators	**05**	**10**	**1,2**	**CO5**	**PSO 1 PSO 2**	**(Emp),(Ent),(SD)**	**(L),(N),(R),(G)**	**(PE)**

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	**09**	**17**	**1,2,3**	**CO3**	**PSO 1, PSO 2**	**(Emp),(Ent),(SD)**	**(L),(N),(R),(G)**	**(PE)**
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.	**06**	**12**	**1,2,3**	**CO6**	**PSO 1, PSO 2**	**(Emp),(Ent),(SD)**	**(L),(N),(R),(G)**	**(PE)**

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

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B E (Civil – IWM):

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application- oriented solutions.

PSO2 Analyze and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Applied Mechanics**		**Academic Year**	**2023-24**
B E (Civil – IWM): Regular programme				
Year	**II**	**Core / ~~Elective / Foundation~~** **APM 1415CS: Concrete Technology & Elementary RCC**	**Credits / Hours per week**	**03/03**
Semester	**II**	Year of Introduction: 2023 Year of Syllabus Revision: ----	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures		

Course Outcome (CO) APM 14XX

Students will be able to

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 programing 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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
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.	12	25	1,2	CO1	PSO1	Emp,Ent,SD	G	PE
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,**	05	12	1,2,	CO2	PSO1	Emp,Ent,SD	N	PE
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.**	08	22	1,2, 3	CO2	PSO1	Emp,Ent,SD	N	PE
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.**	06	18	1,2, 3,4	CO2	PSO1	Emp,Ent,SD	N	PE

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.**	02	05	1,2	CO3	PSO1	Emp,Ent,SD	G	PE
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.**	06	18	1,2,4	CO3	PSO1, PSO2	Emp,Ent,SD	N	PE

References:	
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.

POs

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
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PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1: Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.
PSO2: Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Mechanics	Academic Year	2023-24

B E (Civil – IWM): Regular Program

Year	**II**	**Core / ~~Elective / Foundation~~** **APM 14XXL: Concrete Technology & Elementary RCC**	**Credits / Hours per week**	**01/02**
Semester	**II**	Year of Introduction: 2023 Year of Syllabus Revision:	**Maximum Marks / Grade**	**50**
Mode of Transaction		Tutorial, discussion and viva		

No.	Experiment	Contact Hours	Weightage (%)	BT Level	CO	PSO
1	Fineness Test of Cement	02	7	2,3	CO1	PSO1
2	Standard Consistency Test	02	7	2,3	CO1	PSO1
3	Initial and Final Setting time	02	7	2,3	CO1	PSO1
4	Compressive strength of cement	02	7	2,3	CO1	PSO1
5	Soundness of cement	02	7	2,3	CO1	PSO1
6	Bulk density of aggregates	02	7	2,3	CO1	PSO1
7	Sieve Analysis	02	7	2,3	CO1	PSO1
8	Bulking of sand	02	7	2,3	CO1	PSO1
9	Slump Test and Compaction Factor Test	02	7	2,3	CO2	PSO1
10	Compressive strength of concrete	02	7	2,3	CO2	PSO1
11	Flexure and Tensile Strength of concrete	02	7	2,3	CO2	PSO2
12	Seminar on special concrete and group discussion	04	9	2,3	CO3	PSO1

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B.E. (Civil-IWM)

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application- oriented solutions.

PSO2 Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

Syllabus of Course

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		**Academic Year**	**2023-24**
B E (Civil – IWM): Regular Programme				
Year	**II**	**Core / ~~Elective / Foundation~~ APM 1413CS: NUMERICAL METHODS AND COMPUTER APPLICATIONS**	**Credits / Hours per week**	**03**
Semester	**II**	Year of Introduction: 2020-21 Year of Syllabus Revision:2023	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures		
Course Outcome (CO) APM14XX 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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship(Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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.	20	50%	2, 3, 6	CO2 CO3	PSO1 ,2	SD	G	
2	Study of Spreadsheets: Introduction to spreadsheet package and its Applications in Civil Engineering.	**02**	**5%**	**1,2**	**CO1**	**PSO1 ,2**			
3	Drafting: Introduction to drafting package and it's applications in 2D and 3D. Introduction to Building information modeling.	**02**	**5%**	**1,2**	**CO2**	**PSO1 ,2**			
4	Numerical Methods: Initial value problems and methods of solutions such as Picard method, Euler's method and Runga-Kutta method, Numerical Integration and Differentiation. Finding roots of algebraic and transcendental equations. False position method. Civil engineering application of all above methods.	**15**	**40%**	**2, 3, 4, 5**	**CO4 CO5 CO6**	**PSO1 ,2**			

Reference Books

1.	Fundamentals of Computers – Rajaraman V., 3rd Edition, Prentice Hall of India, New Delhi, 1999.
2.	The C Programming Language – Ritchie, D. M. and Kernighan B. W., 2nd 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

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering	Academic Year	2023-24

B E (Civil – IWM): Regular Programme

Year	II	Core / ~~Elective / Foundation~~ APM 1413LCS: NUMERICAL METHODS AND COMPUTER APPLICATIONS	Credits / Hours per week	02
Semester	II	Year of Introduction: 2020-21 Year of Syllabus Revision: 2023	Maximum Marks / Grade	50
Mode of Transaction		Tutorials		

No.	Tutorials	Contact Hours	Weightage (%)	BT Level	CO	PSO
1	Matrices and Determinants	02	05	1,5	CO4	PSO1,2
2	Introduction to Computer and MS Excel	02	05	1,2,3	CO1	PSO1,2
3	Introduction to C-programming	02	10	1,2,3	CO2	PSO1,2
4	Simple C programs	02	10	3,6	CO2	PSO1,2
5	C- programs with control Statements	04	15	3,6	CO2	PSO1,2
6	C- programs using Arrays	04	15	3,6	CO3	PSO1,2
7	Initial value Problem-1	02	10	2,5	CO2	PSO1,2
8	Initial value Problem-2	02	10	2,5	CO4	PSO1,2
9	Roots of Non-Linear Equation	02	10	4	CO5	PSO1,2
10	Numerical Integration	04	10	4	CO6	PSO1,2

POs

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
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PSO1: Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.
PSO2: Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B.E (Civil - IWM)

Programme Specific Outcome (PSO)

PSO1: Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application-oriented solutions.
PSO2: Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable

Syllabus of Courses (New Syllabus)

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Mechanics		**Academic Year**	**Year of implementation: 2023-24**
B E (Civil – IWM): UG Regular Programme				
Year	**II**	**Core / ~~Elective / Foundation~~ APM1416CS: Applied Geology and Geotechniques**	**Credits / Hours per week**	**04/04**
Semester	**II**	Year of Introduction: 2023 Year of Syllabus Revision: -	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) APM14XX
Students will be able to
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.

1	2	3	4	5	6	7	8	9	10

Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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	**16**	**33.0**	**1,2,3**	**CO1**	**PSO1**	**EMP,SD**	**G**	**ES,PE**
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	**14**	**25.0**	**1,2,4**	**CO2, CO3**	**PSO1 PSO2**			
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	**14**	**25.0**	**2, 3, 4**	**CO4**	**PSO1 PSO2**			

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.	**08**	**17.0**	**3,4,5**	**CO4, CO5, CO6**	**PSO1 PSO2**			

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 Faculty Technology and Engineering Department of Applied Mechanics		**Academic Year**	**2023-24**
	B. E. (Civil – IWM): UG Regular Programme			
Year	**II**	**Core / ~~Elective / Foundation~~** APM14XX L**: Applied Geology and Geotechniques**	**Credits / Hours per week**	**01/02**
Semester	**II**	Year of Introduction: 2023 Year of Syllabus Revision: --	**Maximum Marks / Grade**	**50**
Mode of Transaction		Laboratory Experiments, discussion and viva		

No.	Experiment	Contact Hours	Weightage (%)	Course Code	BT Level	CO	PSO
1	Water Content Test, Field Density by Core Cutter and Sand Replacement Method	4	10	APM14 XXL	1,3	CO1	PSO1 PSO2
2	Sieve Analysis, Consistency Limits	4	10		3,5	CO1	
3	Standard Proctor Test	2	10		2,3	CO3	
4	Permeability Test, Specific Gravity of Soils	2	10		1,2,3	CO1, CO4	
5	Consolidation Test	4	10		3,4	CO4, CO6	
6	Unconfined Compressive Strength Test	2	10		1,2,3	CO5, CO6	
7	Direct Box Shear Test	2	10		1,3	CO5, CO6	
8	Triaxial Test	4	10		4,5	CO5, CO6	
9	Mini Project	2	20		4,5,6	CO1, CO2, CO3, CO4, CO5,CO6	PSO1. PSO2

POs

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

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
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PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
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PSO1: Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.
PSO2: Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Program Name: Bachelor of Engineering (Civil - IWM)

Programme Specific Outcome (PSO)

PSO1: Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.

PSO2: Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Applied Mechanics**		**Academic Year**	**2024-2025**
Bachelor of Engineering (Civil - IWM): Regular Program				
Year	**III**	**Core / ~~Elective / Foundation~~** **APM1503CS :Theory of Structures**	**Credits / Hours per week**	**04/04**
Semester	**I**	Year of Introduction: 2024 Year of Syllabus Revision: -	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

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.

	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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	12	20	1,2,3,4	CO1	PSO1 PSO2	EMP	G	ES/PE
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.	09	15	2,3,4,5	CO2	PSO1 PSO2			

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.	09	15	2,3,4	CO3	PSO1 PSO2	EMP	G	ES/PE
4	**Introduction to matrix methods of analysis.** Introduction to force and displacement method of analysis. Stiffness system approach for continuous beams.	09	15	2,3,4	CO4	PSO1 PSO2	EMP	G	ES/PE
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.	12	20	2,3,4,6	CO5	PSO1 PSO2	EMP	G	ES/PE
6	**Unsymmetrical bending.** Calculation of maximum and minimum stresses in cross section of beams subjected to unsymmetrical bending.	09	15	2,3,4	CO6	PSO1 PSO2	EMP	G	ES/PE

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.

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering.**		**Academic Year**	**2024-25**
Bachelor of Engineering (Civil - IWM): Regular Programme				
Year	**III**	**Core / ~~Elective / Foundation~~** **APM1503LCS : Theory of Structures**	**Credits / Hours per week**	**01/02**
Semester	**I**	Year of Introduction: 2023 Year of Syllabus Revision: -	**Maximum Marks / Grade**	**50**
Mode of Transaction		Laboratory Experiments, discussion, Explanation and Term work Incl viva		

No.	**Experiment**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**
1	Influence line diagram for Shear Force.	2	12	2	CO5	PSO2
2	Influence line diagram for Bending moment	2	12	2,3	CO5	PSO2
3	Influence line diagram for Deflection	2	12	3,4	CO5	PSO1,PSO2
4	Verification of Moment distribution method for Continuous beam.	2	10	3,4	CO1	PSO1,PSO2

5	Sway force in portal frame by using Moment distribution method.	2	12	2,3	CO3	PSO1,PSO2
6	Horizontal reaction for Portal frame by using Moment distribution method.	2	12	2,3	CO3	PSO2
7	Verification of slope Deflection method for Continuous beam.	2	10	2,3	CO1	PSO1,PSO2
8	Horizontal reaction for portal frame by using Slope deflection method.	2	12	3,4	CO3	PSO1,PSO2
9	Determination of deflection in simply supported beams using unit load method	2	10	2,3	CO2	PSO1,PSO2

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Applied Mechanics and Structural Engineering**	**Academic Year**	**2024-25**

Bachelor of Engineering (Civil - IWM): Regular Programme

Year	**III**	**Core / ~~Elective~~ / ~~Foundation~~** **APM1504CS Geotechnical Engineering**	**Credits / Hours per week**	**04/03L+01T**
Semester	**I**	Year of Introduction: 2024 Year of Syllabus Revision: -	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures		

Course Outcome (CO) APM1504CS At the end of course student will be able

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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

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 .	15	25	2,3,4,5 ,6	CO1 CO2	PSO1	EMP,E N T,SD	G	ES,PE
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	15	25	1,2,3,4	CO3	PSO1 PSO2			
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	15	25	1, 2, 3,4	CO5	PSO1 PSO2			
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	15	25	1, 2, 3,4	CO4, CO6	PSO1 PSO2			

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.

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: B.E. (Civil - IWM): Regular Programme

Programme Specific Outcome (PSO)

PSO1 Apply knowledge of mathematics, science and basic engineering fundamentals to solve problems of Civil Engineering.
PSO2 Demonstrate knowledge and understanding of principles of Civil Engineering by using tools and methodologies to provide application oriented solutions.
PSO3 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and environment friendly.
PSO4 Identify and recommend materials and technologies for effective and sustainable solutions.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**		**Academic Year**	**2019-20**
B.E. (Civil - IWM): Regular Programme				
Year	**III**	**Core / ~~Elective / Foundation~~** **CVL1508CS:**ESTIMATION, VALUATION AND PROFESSIONAL PRACTICE	**Credits / Hours per week**	**4L+2TW**
Semester	**I**	Year of Introduction: 2007 Year of Syllabus Revision: 2012	**Maximum Marks / Grade**	**100+50=150**
Mode of Transaction		Lectures and Tutorials	**B.E. (Civil Engineering) : Regular Programme**	

Course Outcome (CO)

CO1 Learn methods for Approximate and Detailed Estimate of Civil Engineering Works.
CO2 Analysis of Rates for various items of Civil engineering constructionwork.
CO3 Understanding method of preparing Tender document and inviting tender notice.
CO4 Learn various methods for allocation of Civil construction work on Contract basis and Administrative procedure followed for contract.
CO5 Learn all aspect of Valuation and methods of valuation of Real property.
CO6 Understanding the principle of specification writing, and drafting technical specification for items of Civil construction work.

Unit No.	**Topic**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional (R)/Global (G)	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional

									Ethics (PE)
1.	Types of Estimate – Approximate and Detailed– Estimate of Civil Engineering Work Standard mode and units of measurements Estimate of Buildings – Residential Estimate of Buildings –Public	10	19%	1,2	CO1	PSO2 PSO3	Emp & SD	N, R	PE
2.	Estimate of RCC works , Column, Beam and Slab, Retaining wall, Estimate of Culvert, Road, Estimate of Water Supply and Sanitary works, Irrigation works, Estimate of steel structures.	6	12%	1,2	CO1	PSO2 PSO3	Emp & SD	N, R	PE
3	Task work of Labours, Material and Labour schedule Framing Rate analysis S.O.R.	6	12%	2,4	CO2	PSO2 PSO3	Emp & SD	N, R	PE
4	Tendering and contract procedures, Types and relative merits, P.W.D. System of administration accounts and Technical sanctions – Billing and Extra item works organization. Arbitration procedure.	13	25%	1,2,5	CO3 CO4	PSO2	Emp & SD	N, R	PE
5	Valuation – Terms related to the Valuation of Real property Factors affecting Valuation of Land and Building Depreciations methods, Sinking fund, Cash flow diagram. Methods of Valuation of Real property-Valuation tables– Valuation reports. Fixation of standard rent	11	21%	3,4,5	CO5	PSO2 PSO3	Emp & SD	N, R	PE
6	Specification – Writing principles Technical Specification for Earthwork, Brickwork, RCC	6	12%	2,5,7	CO6	PSO2 PSO3	Emp & SD	N, R, G	PE

Reference Books

1	Elements of Estimating and Costing (Professional practice) -S.C.Rangwala Pub., Charotar Book stall.
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 Estimates and costing (Civil Engg.) PG.S.Birdi, Pub., Dhanpatrai and sons.
5	Estimating, costing, specification and valuation in Civil Engg. principles and applications and M.Chakraborti Pub., M. Chakraborty 10th edition.
6	Valuation of Real properties – S.C.Rangwala pub. Charator 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.
9	Quantity Survey (Estimation & CE Work – PLBHasin (Pub. S.C.Chand & Co.
10	Mode of Measurements of Civil Engineering Works – I.S.1200.

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**		**Academic Year**	**2020-21**
B E Civil : Regular Program				
Year	**III**	**Core / ~~Elective / Foundation~~** **CVL1508LCS**	**Credits / Hours per week**	**02 Hrs TW/week**
Semester	**II**	Year of Introduction: Year of Syllabus Revision: 2012	**Maximum Marks / Grade**	**50**

Course Outcome (CO) CVL 1508LCS

CO1 work out estimate of various items of civil engineering construction
CO2 work out estimate for RCC work
CO3 Analyse Rate for various items of civil engineering construction
CO4 Understand the procedure for preparation of contract, tender and valuation report
CO5 Prepare the draft for technical specification of various civil engineering work

Mode of Transaction	Analysis, Evaluation, technical discussion and viva	**PSO1 is common for all experiments**				
No.	Term-work based on syllabus of subject	**Contact Hours**	**Course Code**	**BT Level**	**CO**	**PSO**
1	Estimate of Residential Building	8 hours	CVL1508 LCS	3,4,5,6	CO1	PSO2
2	Estimate of RCC beam , slab, column	2 hours	CVL1508 LCS	3,4,5	CO2	PSO2
3	Estimate of RCC retaining wall, water tank	2 hours	CVL1508 LCS	3,4,5	CO2	PSO2
4	Estimate of Septic tank	2 hours	CVL1508 LCS	3,4,5	CO1	PSO2
5	Estimate of Wood work- Door/Window and Steel fabrication work- Roof truss.	3 hours	CVL1508 LCS	3,4,5	CO1	PSO2, PSO4

6	Estimate of Road construction	2 hours	CVL1508 LCS	3,4,5	CO1	PSO2
7	Drafting of Technical specification of various items of civil construction work	2 hours	CVL1508 LCS	5, 6	CO5	PSO2, PSO4
9	Preparation of Tender document , Valuation of Real property	3 hours	CVL1508 LCS	3,4,5,6	CO4	PSO2
10	Preparation of Rate analysis of civil construction work	2 hours	CVL1508 LCS	3,4,5,6	CO3	PSO2 PSO3

Syllabus of Courses

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Water Resources Engineering and Management Institute**		**Academic Year**	**2025-26**
F.S. OF B.E.-III (CIVIL – IRRIGATION WATER MANAGEMENT)			
Year	**III**	**Core / ~~Elective / Foundation~~** **WRE1503CS : ENGINEERING HYDROLOGY**	**Credits / Hours per week**	**3L**
Semester	**I**	Year of Introduction : 1991 Year of Syllabus Revision : 2020	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1503CS

CO1 To understand the basic fundamentals of hydrologic cycle
CO2 To understand and analyze the effects pf urbanization on hydrology.
CO3 To understand types & forms of precipitation & to carry out rainfall analysis.
CO4 To emphasize on evaporation process & to be able to estimate evaporation.
CO5 To be familiarized with infiltration process & able to estimate infiltration rate & its indices.
CO6 To emphasis on runoff & its characteristics & to develop rainfall runoff relationship
CO7 To understand the flow behavior with respect to time and to become familiar with application of hydrograph.
CO8 To carry out flood frequency analysis and to be familiar with process of flood routing in reservoir and channels

Unit No.	**Topic**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional (R)/Global (G)	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional

									Ethics (PE)
1	Development in hydrology and it's role in water resources projects. Hydrologic cycle. Hydrology as applied in engineering. Catchment characteristics. Drainage patterns. Classification of catchments. Weather & climate, humidity, temperature, radiation, wind. Definition of droughts. Classification of droughts. Drought management. Drought frequency.	6	12	1, 2	CO1	PSO4	Emp/ SD	L / N / R	ES
2	Introduction, Purpose & scope, Urbanization, Environmental effects, Urban hydrology, Urban hydrological research & development, Urban hydrological system, Urbanization & its effects on water cycle, Urbanization indices, Effects of urbanization on hydrology, Climatic effects, Changes in surface & groundwater flows, Current activities, Recommendation for international action	6	12	1, 2, 3, 4	CO2	PSO4			
3	Precipitation. Types and forms of precipitation. Characteristics of precipitation in India. Rain gauging instruments and their installation. Hydrometric network. Optimum network. Preparation of data. Presentation of rainfall data. Mean precipitation over an area. Depth area- duration relationships. Frequency of point rainfall. Intensity-duration-frequency relationship. Probable maximum precipitation. Design Rainfall, Construction of Design storm hyetograph	8	14	1, 2, 3, 4	CO3	PSO4			
4	Evaporation process. Factors controlling the evaporation process. Evaporimeters. Empirical evaporation equations. Water-budget determination of reservoir evaporation. Energy-budget determinations of reservoir evaporation. Aerodynamic determination of reservoir evaporation. Combination methods of estimating reservoir evaporation. Estimation of reservoir evaporation from pan evaporation and related meteorological data. Reservoir evaporation and methods for its reduction.	6	12	1, 2, 3, 4	CO4	PSO4			
5	Infiltration process. Infiltration capacity of soil. Factors influencing infiltration capacity. Methods of determining infiltration capacity. Infiltration indices. Infiltration measurement. Cylindrical method. Ponding method. Measurement of infiltration in furrow. Blocked furrow method. Recycling furrow infiltrometer. Infiltration equations.	6	12	1, 2, 3, 4	CO5	PSO4			
6	Phenomena of runoff. Catchment characteristics and their effects on runoff. Climatic factors. Rainfall-runoff correlation. Methods of estimation. Flow rating curves. Determination of flow-rating curves. Adjustment and extension of flow-rating curves. Volume and durations of runoff. Estimating snow-melt runoff.	6	12	1, 2, 3, 4	CO6	PSO4			

7	Hydrograph, Factors affecting flood hydrograph. Components of hydrograph. Contribution of base flow to stream discharge. Separation of base flow and runoff. Evaluation of base flow. Effective rainfall. Determination of total runoff. Direct runoff hydrograph. Unit hydrograph. Derivation of unit hydrograph. Unit hydrographs of different durations. Use and limitations of unit hydrograph. Instantaneous unit hydrograph. Synthetic unit hydrograph. Unit hydrograph from catchment characteristics by FSR method.	8	14	1, 2, 3, 4	CO7	PSO4			
8	Flood formulae. Frequency analysis. Flood routing. Storage equation. Reservoir routing. Routing in river channel. Synthetic unit graphs from flood routing.	6	12	1, 2, 3, 4	CO8	PSO4			

Reference Books

1.	Raghunath H.M “Hydrology”, Wiley Eastern Publication
2.	Reddy Jayarami, “Engineering Hydrology”, Laxmi Publication
3.	Subramanya K, “Engineering Hydrology”, - Tata McGraw Hill Publication
4.	Engineering Hydrology – Wilson
5.	Urban Hydrology, Hydraulics & Storm Water Quality – Willey Publication – A. Osman, Akan & Robert J. Houghtalen
6.	Hall M. J. (1984), Urban Hydrology”, Elsevier Applied Science Publishers
7.	“Hydrological Effects of Urbanization”, A report of the sub-group on the effects of urbanization on the hydrological environment, The UNESCO Press, Paris 1974, ISBN No.: 92-3-101223-1

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Water Resources Engineering and Management Institute	Academic Year	2025-26

F.S. OF B.E.-III (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	III	Core / ~~Elective / Foundation~~ WRE1503LCS : Laboratory Practical	Credits / Hours per week	2P
Semester	I	Year of Introduction: 1991 Year of Syllabus Revision: 2020	Maximum Marks / Grade	50
Mode of Transaction		Laboratory Experiments, discussion and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Demonstration of Raingauge	3	1503LCS	1,2,3,4	CO3	PSO4
2	Experiment on Pan Evaporimeter	4	1503LCS	1,2,3,4	CO4	PSO4
3	Evaporation in excavation tank	4	1503LCS	1,2,3,4	CO4	PSO4
4	Determination of infiltration rate by single ring infiltrometer	4	1503LCS	1,2,3,4	CO5	PSO4
5	Determination of infiltration rate by double ring infiltrometer	4	1503LCS	1,2,3,4	CO5	PSO4
6	On filed measurement of runoff	4	1503LCS	1,2,3,4	CO6	PSO4
7	Development of Hydrograph	3	1503LCS	1,2,3,4	CO7	PSO4

Syllabus of Courses

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Water Resources Engineering and Management Institute**		**Academic Year**	**2025-26**
F.S. OF B.E.-III (CIVIL – IRRIGATION WATER MANAGEMENT)			
Year	**III**	**Core / ~~Elective / Foundation~~** **WRE1504CS : GROUND WATER HYDRAULICS**	**Credits / Hours per week**	**3L**
Semester	**I**	Year of Introduction : 1991 Year of Syllabus Revision : 2020	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1504CS

CO1 To understand development, potential and legislate of ground water.
CO2 To be able to understand various type of aquifers and its properties.
CO3 To be familiar with behavior of well hydraulics in various flow condition and to understand multiple well system and its response under various flow condition.
CO4 To understand design of tube well and various component and understanding working of various types of pumps and its applications.
CO5 To study various surface and subsurface techniques of ground water investigation and artificial recharge.
CO6 To understand the concept of rainwater harvesting and its design criteria.
CO7 To study the effects of sea water intrusion and prevention strategies.

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional

									Ethics (PE)
1	Introduction, Ground water development in India, Areas of groundwater potential in India, Conjunctive use of ground water, Ground water legislation and pollution	7	13	1, 2	CO1	PSO4	Emp/ SD	L / N / R	ES
2	Aquifers, Various types of aquifer, Ground water terminology, Aquifer properties, Specific yield, Determination of specific yield laboratory and field methods, Storage coefficient, Transmissibility, Ground water movement, Darcy's Law, Kozney's relations permeability, Factor affecting permeability, Relationship between storage coefficient, Barometric and tidal efficiencies	8	16	1, 2, 3, 4	CO2	PSO4			
3	Well hydraulics, Steady radial flow into a well situated in a confined and unconfined aquifer, unsteady radial flow in confined and unconfined aquifer Well flow near aquifer boundaries, Method of images, Multiple well systems	7	13	1, 2, 3, 4	CO3	PSO4			
4	Types of tube wells, Design of tube wells, Tube well construction, Percussion drilling, Hydraulic rotary drilling, Well development, Well completion, Yield test. Pumps. Types of pump, Shallow and deep well pumps	8	16	1, 2, 3, 4	CO4	PSO4			
5	Introduction to groundwater geophysics, Geophysical investigation, Different methods of ground water exploration techniques and Artificial recharge techniques, Induced infiltration, Water spreading recharge pits & shafts, Recharge wells, Rain water harvesting	8	16	1, 2, 3, 4	CO5	PSO4			
6	Introduction to rain water harvesting, Need for RWH, Advantages of RWH, RWH potential, Methods of RWH, Components methods of recharging subsurface aquifers, Design criteria for RWH and Case studies	7	13	1, 2, 3	CO6	PSO4			
7	Saline water intrusion, Ghyben-Herzberg equation Slope, Shape and movement of interface, Prevention and control of saline water intrusion, artificial recharge	7	13	1, 2, 3	CO7	PSO4			

Reference Books

1.	Karanth, K. R. "Ground water assessment development and management". Tata McGraw-Hill Publishing co.
2.	Michael, A. M. and Khepar, S. D. "Water Well and Pump Engineering". Tata McGraw Hill Publishing Co.
3.	Raghunath, H. M. "Ground water". Willey Eastern limited
4.	Todd, D. K. "Ground water hydrology". John Wiley and sons

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Water Resources Engineering and Management Institute	Academic Year	2025-26

F.S. OF B.E.-III (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	III	Core / ~~Elective / Foundation~~ WRE1504LCS : Laboratory Practical	Credits / Hours per week	2P
Semester	I	Year of Introduction: 1991 Year of Syllabus Revision: 2020	Maximum Marks / Grade	50
Mode of Transaction		Laboratory Experiments, discussion and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Measurement of Groundwater Table	5	1504LCS	1,2,3,4	CO1	PSO4
2	Demonstration of various types of strainers	5	1504LCS	1,2,3,4	CO4	PSO4
3	Recharge in excavation tank	5	1504LCS	1,2,3,4	CO5	PSO4
4	Demonstration of electrical resistivity meter	6	1504LCS	1,2,3,4	CO5	PSO4
5	Demonstration of rainwater harvesting system	5	1504LCS	1,2,3,4	CO6	PSO4

Bloom's Taxonomy Levels: 1. Remember 2. Understand3. Application 4. Analysis 5. Evaluation 6. Creation

ProgrammeName:B.E– III (Civil - IWM)

Programme Specific Outcome(PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.
PSO 2 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		**Academic Year**	**2024-25**
B.E.- III (Civil - IWM): Regular Programme				
Year	**III**	**Core / ~~Elective / Foundation~~ CVL 1513CS: Basic Transportation Systems**	**Credits / Hours per week**	**3 hours/week**
Semester	**II**	Year of Introduction: **2024-25** Year of Syllabus Revision:	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures		

Course Outcome (CO) CVL 1513CS

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 it's 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 it's components

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	**RAILWAY ENGINEERING** Permanent Way Cross sectional elements, Types, Selection of Sleepers, Ballast, creep, alignment, Rails and Fixtures and Fastenings, Maintenance programs	08	19	2	1	PSO1	Emp, Ent, SD	L, N, R, G	ES, PE
2	Railway points and crossing and turnout, their components and layout consideration, Railway Signalling and Control systems	7	17	2	2	PSO1, PSO2			
3	Railway Station Yards, Layouts and Equipments, Stresses in Track Structures Modernization of Railway Track	6	14	2,3	1,2	PSO1 PSO2			
4	**BRIDGE ENGINEERING** Bridge Engineering- Introduction, Structures, Functions of Components, Bearing for Bridge Structure, Classification criteria, Bridge Site selection criteria and investigation	2	5	2,3	3	PSO1			

5	Hydraulic aspect of bridge design-Design parameters & approach, Examples based on theory	**4**		**9**	**2,3,4**	**4**	**PSO1, PSO2**		
6	Low-cost bridges, Types of bridge superstructure, Bridge substructures- pier, abutment and wing wall	**5**		**11**	**2,3**	**3**	**PSO1**		
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	**4**		**11**	**2,3**	**4,5**	**PSO1**		
8	Types & characteristics of Marine Structures-Breakwater, Piers, Wharf, Quay, Jetty, Fender, Dolphin and Dock structures Navigational aids: Necessity, Types-Fixed and Floating	**6**		**14**	**2,3**	**5**	**PSO1**		

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.

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**	**Academic Year**	**2024-25**

B.E- III (Civil - IWM): Regular Programme

Year	**III**	**Core / ~~Elective / Foundation~~** **CVL1513LCS : Basic Transportation Systems: Tutorial**	**Credits / Hours per week**	**01**
Semester	**II**	Year of Introduction: **2024-25** Year of Syllabus Revision:	**Maximum Marks / Grade**	
Mode of Transaction		Tutorial		

No.	**Tutorial**	**Contact Hrs**	**Course Code**	**BT Level**	**CO**	**PSO**
1	Examples of sleeper density, ballast depth, rail type selection	02	CVL 1513LCS	3	1	PSO1, PSO2
2	Tractive resistances	02	CVL 1513LCS	3	2	PSO1, PSO2
3	Design calculations of turnout and cross-over	04	CVL 1513LCS	3,4	2	PSO1, PSO2
4	Example of economic span, scour depth and afflux determination	02	CVL 1513LCS	3,4	4	PSO1, PSO2
5	Design calculation for hydraulic aspect of bridge design	02	CVL 1513LCS	3,4	4	PSO1, PSO2
6	Assignment: Harbour planning & Marine structures	02	CVL 1513LCS	3	4,5	PSO1

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Water Resources Engineering and Management Institute**		**Academic Year**	**2025-26**

S.S. OF B.E.-III (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	**III**	**Core / ~~Elective / Foundation~~** **WRE1602CS: SOIL AND WATER CONSERVATION ENGINEERING**	**Credits / Hours per week**	**3L**
Semester	**II**	Year of Introduction : 2006 Previous Year of Syllabus Revision : 2021	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1602CS

CO1 To understand various properties on soil & its movement in to soil
CO2 To be familiar with different soil moisture constants
CO3 To study soil erosion and its estimation, soil loss models
CO4 To study various types of soil erosion
CO5 To study control and conservation practices of soil erosion
CO6 To understand various sediment load & its effect on sediment - quality – quantity
CO7 To get familiar with watershed & demarcation on watershed boundaries and related studies and to study various watershed development case studies in India
CO8 To study in detail on-farm water conservation methods and to have hands on practice of software for watershed delineation and demarcations.

Unit No.	**Topic**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional (R)/Global (G)	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

1	Nature and properties of soil. Chemical properties. pH. Salinity, ESP, SAR. Macro and micro nutrients. Toxic elements. Biological properties. Organic matter. Micro organism. Water relations of soil. Kinds of soil water. Movement of water into soils. Soil moisture retention and movement. Viscosity. Surface tension and capillary soil moisture tension.	7	13	1, 2	CO1	PSO3	Emp/ SD	L / N / R	ES
2	Soil moisture constants. Saturation capacity. Field capacity. Moisture equivalent. Permanent wilting percentage. Available water. Soil water potential energy concept. Soil moisture measurement methods. Plant water relationship. Soil profile. Major group of soil. Land use classification.	9	17	1, 2, 3, 4	CO2	PSO3			
3	Soil erosion. Geological erosion. Accelerated erosion. Types of soil erosion. Wind erosion. Water erosion. Estimation of soil erosion. Soil loss models.	10	20	1, 2, 3, 4	CO3	PSO3			
4&5	Controlling soil erosion. Soil erosion by wind. Soil erosion by water. Land capability classes. Soil conservation practices. Vegetative practices. Mechanical practices. Erosion Control in torrent and gullies.	7	13	1, 2, 3, 4	CO4 CO5	PSO3			
6	Sedimentation. Sediment yield models. Sediment graphs. Bed load models	6	12	1, 2, 3, 4	CO6	PSO3			
7	Watershed management. Need for watershed management. Expected benefits. Watershed as a unit of development. National watershed atlas. Demarcation of watershed boundary. Categorization of watersheds. Resource inventory. Socio economic survey. Participatory rural appraisal. Project formulation strategy. Contents of project proposal. Technical plan. Watershed development and management-case studies.	7	13	1, 2, 3, 4	CO7	PSO3			
8	On-farm water conservation methods. Farm Ponds, Excavation Tanks and to have hands on practice of software for watershed delineation and demarcations.	6	12	1, 2, 3, 4	CO8	PSO3			

Reference Books

1.	Dastane, N. G. “A Practical Manual in Irrigated Agriculture”, Nav Bharat Prakashan, Pune.
2.	Dhruvanarayana, V. V. “Soil and Water Conservation Research in India”. Indian Council of Agricultural Research.
3.	Ghanshyam Das. “Hydrology and Soil Conservation Engineering” Prentice Hall of India Pvt. Ltd., New Delhi.
4.	Gupta, S. K. & Gupta, T. C. “Management of Saline Soils & Waters”, Selectifile Publishing.
5.	Gurmel Singh, Venkatramanan, C., Sastry, G. and Joshi, B. P. “Manual of Soil and Water Conservation Practices”. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6.	James, D. W., Hanke, R. J., Jurinak. “Modern Irrigated Soils”, John Wi8lley & Sons, New York.
7.	Kolay, A. K. “Basic Concepts of Soil Science”, Wiley Eastern Limited.
8.	Michael, A. M. “Irrigation Theory and Practice”, Vikas Publishing House, New Delhi.
9.	Misra, R. D. & Ahmed, M. “Manual of Irrigation Agronomy”, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

10.	Schwab, G. O., Frevert, R. K., Edminster, T. W. and Barnes, K. K. “Soil and Water Conservation Engineering”. John Wiley & Sons, New York.
11.	Maitra, M.K. “Watershed Management – Project Planning, Development and Implementation” Omega Scientific Publisher, New Delhi.

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Water Resources Engineering and Management Institute	Academic Year	2025-26

S.S. OF B.E.-III (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	III	Core / ~~Elective / Foundation~~ WRE1602LCS:SOIL AND WATER CONSERVATION ENGINEERING	Credits / Hours per week	Year
Semester	II	Year of Introduction : 2006 Previous Year of Syllabus Revision : 2021	Maximum Marks / Grade	Semester
Mode of Transaction		Laboratory Experiments, discussion and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Determination of field density by core cutter method	2	1602LCS	1,2,3,4	CO2	PSO3
2	Determination of field density by water displacement method	3	1602LCS	1,2,3,4	CO2	PSO3
3	Determination of specific gravity by density bottle method	3	1602LCS	1,2,3,4	CO2	PSO3
4	Particle distribution test of soil	3	1602LCS	1,2,3,4	CO2	PSO3
5	Determination of organic matter content in the given soil sample sedimentation analysis	2	1602LCS	1,2,3,4	CO2	PSO3
6	Sedimentation analysis	2	1602LCS	1,2,3,4	CO2	PSO3
7	Double ring infiltrometer test	7	1602LCS	1,2,3,4	CO2	PSO3
8	Tensiometer	2	1602LCS	1,2,3,4	CO2	PSO3
9	Pressure plate technique	2	1602LCS	1,2,3,4	CO2	PSO3
10	Hands on practice of software for watershed delineation and demarcations.	2	1602LCS	1,2,3,4	CO7	PSO3
11.	Design of Farm Ponds	2	1602LCS	1,2,3,4	CO8	PSO3
12.	Design of Excavated Tanks	2	1602LCS	1,2,3,4	CO8	PSO3

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Applied Mechanics & Structural Engg.**		**Academic Year**	**2024-2025**
B.E.CIVIL – IWM : UG				
Year	**III**	**CORE** **APM1611CS FUNDAMENTALS OF STRUCTURAL DESIGN**	**Credits / Hours per week**	**3**
Semester	**II**	Year of Introduction: 2024 Year of Syllabus Revision: 2024	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) APM1602. Students will be able to.

CO1 Design RC member for shear, development length and deflection and cracking.
CO2 Design of one way, two way and continuous slabs and stairs
CO3 design of different types of beams.
CO4 Apply methods of design for steel structure.
CO5 Evaluate the properties of steel section and design the connections for axially loaded members.
CO6. Design axially loaded members and flexural members in steel structure.

Unit No.	**Topic/Unit**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional(R)/Global (G) developmental needs	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

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.	10	20%	2,4	CO4,5	PSO1 PSO2			
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	10	20%	2,6	4,6	PSO1 PSO2			
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.	12	30%	6	2,6	PSO1 PSO2			
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,	13	30%	6	3,6	PSO1 PSO2			
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								

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Mechanics	Academic Year	2024-25

B.E. (CIVIL - IWM): Regular Program

Year	III	Core APM1605LCS : FUNDAMENTALS OF STRUCTURAL DESIGN	Credits / Hours per week	02
Semester	II	Year of Introduction:2024 Year of Syllabus Revision: 2024	Maximum Marks / Grade	50
Mode of Transaction		Tutorial, discussion and viva	is common for all experiments	

No.		Contact hours	% weightage	BT Level	CO	PSO
1	Design of small residential building for gravity load only.	6	15	2,3,4	1	PSO1 PSO2
2	Design and drawing of footing	6	25	2,3,4	1	PSO1 PSO2
3	Design and drawing of ground beam and plinth beam	6	15	2,6	3	PSO1 PSO2
4	Design and drawing of lintel, loft and weather shed	6	15	2,6	2	PSO1 PSO2
5	Design and drawing of ground floor slab	6	25	2,3,6	2,3	PSO1 PSO2

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Program Name: B. E. (Civil – IWM)

Program Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application-oriented solutions.

PSO2 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering		**Academic Year**	**2024-25**
B. E. (Civil - IWM): Regular Program				
Year	**III**	**Core / ~~Elective~~ / ~~Foundation~~ CVL 1616CS: Environmental Engineering**	**Credits / Hours per week**	**03+01**
Semester	II	Year of Introduction: 2024-25 Year of Syllabus Revi 2024-25	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) CVL 1616CS

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	Contact Hours (Total =52)	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
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	13		1, 2,3,4	CO1	PSO1		N R G	
2	Quantity of Domestic Wastewater Quantity of Sanitary Sewage, Variation in Sewage Flow, Types of sewerage System	**03**		**1, 2**	**CO1**	**PSO1**			

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	**05**		**2, 3**	**CO3**	**PSO1 PSO2**			
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	**05**		**2, 3, 4**	**CO3**	**PSO1 PSO2**			
5	Development of Water supplies Surface Water supplies and Ground Water Supplies With qualities and quantity in general	**02**		**3, 4,5**	**CO1**	**PSO1 PSO2**			
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 & Mangenes, 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.)	**15**		**3, 4**	**CO2**	**PSO1 PSO2**			
7	Municipal Solid Waste: Classifications, Characteristics, Quantity Estimation, Collection, transportation and disposal methods	**04**		**2,3**	**CO4**	**PSO1 PSO2**			

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.	**05**		**2,3,4**	**CO5**	**PSO1 PSO2**			

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

	The Maharaja Sayajirao University of Baroda Faculty of Technology and Engineering Department of Civil Engineering	Academic Year	2024-25

BE (Civil- IWM): Regular Program

Year	III	Core / ~~Elective / Foundation~~ CVL1616LCS : Practical-Term work	Credits / Hours per week	02
Semester	II	Year of Introduction: Year of Syllabus Revision:	Maximum Marks / Grade	50
Mode of Transaction		Discussion, design project, and viva	PSO1 and PSO2	

No.	Term work/Practicals	Contact Hours	Course Code	BT Level	CO	PSO
1	Drinking Water Standards	1	CVL1616LCS	2,3,4	CO2	PSO1
2	Treated Waste Water Disposal Standards	1	CVL1616LCS	2,3,4	CO2	PSO1
3	Determination of Total Solids	2	CVL1616LCS	2,3,4	CO2	PSO1
4	Determination of Hardness	2	CVL1616LCS	2,3,4	CO2	PSO1
5	Determination of Carbonate Hardness	2	CVL1616LCS	2,3,4	CO2	PSO1
6	Determination of Chlorine Demand	2	CVL1616LCS	2,3,4	CO2	PSO1
7	Determination of Residual Chlorine	2	CVL1616LCS	2,3,4	CO2	PSO1
8	Determination of Dissolved Oxygen (D.O)	1	CVL1616LCS	2,3,4	CO2	PSO1
9	Determination of Biochemical Oxygen Demand (B.O.D)	1	CVL1616LCS	2,3,4	CO2	PSO1
10	Determination of Chemical Oxygen Demand (C.O.D)	2	CVL1616LCS	2,3,4	CO2	PSO1
11	Determination of Most Probable Number (MPN) of coliform organism	2	CVL1616LCS	2,3,4	CO2	PSO1
12	Determination of pH	1	CVL1616LCS	2,3,4	CO2	PSO1
13	Determination of Turbidity (N.T.U)	1	CVL1616LCS	2,3,4	CO2	PSO1
14	Chemical Coagulation of Water	2	CVL1616LCS	2,3,4	CO2	PSO1
15	Determination of Iron	2	CVL1616LCS	2,3,4	CO2	PSO1
16	Determination of Fluoride	1	CVL1616LCS	2,3,4	CO2	PSO1
17	Observation of Microorganisms	1	CVL1616LCS	2,3,4	CO2	PSO1

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4.Analysis 5.Evaluation 6. Creation

Programme Name: B.E. (Civil -IWM): Regular Programme

Programme Specific Outcome(PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application-oriented solutions.

PSO2 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Civil Engineering**	**Academic Year**	**2024-25**

B.E. (Civil - IWM) : Regular Programme				
Year	**III**	**Core / ~~Elective~~ / ~~Foundation~~** **CVL1617CS: Climate Resilient Cities**	**Credits / Hours per week**	**3 / 3Hrs. L/week credits:(03)**
Semester	**II**		**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures	**B.E. (Civil -IWM) : Regular Programme**	

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
CO5 Understanding Stormwater Management Module

Unit No.	**Topic**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional (R)/Global (G)	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

1.	**The physical science of climate change Climate System; Causes of Climate Change.**	**6**	**15.4%**	**1,2**	**CO1**	**PSO1 PSO2**	**Emp & SD**	**G**	**PE**
2.	**Global atmospheric composition: Greenhouse gases and aerosols; Extreme weather events, sea level rise**	**6**	**15.4%**	**1,2**	**CO1**	**PSO1 PSO2**	**Emp & SD**	**G**	**PE**
3	**Climate impacts, vulnerability and risks Assessing climate impacts on key sectors and systems**	**8**	**20.5%**	**2,4,5**	**CO2**	**PSO1 PSO2**	**Emp & SD**	**G**	**PE**
4	**Climate data and trends; Analyses of climate data**	**4**	**10.3%**	**3,4,5**	**CO2, CO3**	**PSO1 PSO2**	**Emp & SD**	**G**	**PE**
5	**Development of Intensity – Duration – Frequency curves, Assessment of carrying capacity of stormwater drains under climate change scenario**	**6**	**15.4%**	**2,3,4**	**CO4, CO5**	**PSO1 PSO2**	**Emp & SD**	**G**	**PE**
5	**Introduction to Stormwater Management Module for analysis and design of storrmwater drains**	**6**	**15.4%**	**3,4,5**	**CO5**	**PSO1 PSO2**	**Emp & SD**	**G**	**PE**
6	**National policies for climate change (NAPCC, national missions).**	**3**	**7.6%**	**4,5**	**CO3**	**PSO1 PSO2**	**Emp & SD**	**G**	**PE**

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. Schl303266mer, 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

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Water Resources Engineering and Management Institute**	**Academic Year**	**2025-26**

F.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	**IV**	**Core / ~~Elective / Foundation~~** **WRE1705CS: WATER RESOURCES ENGINEERING**	**Credits / Hours per week**	**3L**
Semester	**I**	Year of Introduction : 1991 Year of Syllabus Revision : 2020	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1705CS

CO1 To understand the fundamentals of reservoir planning & to carry out economic analysis in water resources planning.
CO2 To familiar with the reservoir zones & its capacity including its yield and to identify demand patterns for multipurpose reservoir to develop rule curves and operating tables for the same.
CO3 To introduce them with classification of types of dams, including their site selection & investigation to be carried out.
CO4 To make them familiar with various types of earth dam their design including failure & stability analysis.
CO5 To make them familiar with various types of gravity dam their design including failure & stability analysis.
CO6 To introduce them with different type of spillways including the study of energy dissipaters & also design of ogee spillway.
CO7 To identify fundamental of diversion head works & carry out uplift pressure analysis using subsurface theories.
CO8 To understand the layouts and methods of water distribution systems.

Unit No.	**Topic**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional (R)/Global (G)	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional

									Ethics (PE)
1	Planning for water resources development. Various purposes served by water resources development projects. Classification of water resources development projects. Water requirement of multipurpose projects. Compatibility of multipurpose uses. Planning of water resources development projects. Engineering economy in water resources development projects. Estimation of benefit-cost ratio. Economic analysis of water resources projects. Capital budgeting. Some common pitfalls in water resources planning.	6	12	1,2,4	CO1	PSO4	Emp/ Ent/ SD	L/N/R/G	ES, HV
2	Reservoir planning. Types of reservoirs. Available storage capacity of a reservoir. Investigations for reservoir planning. Selection of site for a reservoir. Capacity-elevation and area elevation curves of a reservoir site. Storage zones of a reservoir. Mass inflow curve and demand curve. Determination of the required capacity. Fixing the reservoir capacity for the computed value of the dependable yield of the reservoir catchment. Relation between the inflow outflow and storage data for a reservoir. Fixing the reservoir capacity from the annual inflow and outflow data. Determination of yield of reservoir. Analytical method for determination of storage capacity of a reservoir. Demand patterns and optimal operation. Operation plan of a multipurpose reservoir. Apportionment of the total cost of a multipurpose reservoir. Reservoir sedimentation. Reservoir losses. Reservoir clearance.	8	14	1,2,3,4	CO2	PSO4			
3	Dam Engineering. Different classification for dams. Types of dams. Selection of site for a dam. Selection of type of dam. Investigation of dam sites. Engineering surveys. Geological investigations. Sub-surface exploration programme.	6	12	1,2,3	CO3	PSO4			
4	Earth dams. Types of earth dams. Foundation requirements. Causes of failure of earth dams. Criteria for safe design of earth dams. Preliminary section of earth dam. Typical cross sections of earth dams. Checking the stability of an earth dam. Seepage analysis. Phreatic line in an earth dam. Phreatic line for a homogeneous earth dam with or without a horizontal drainage system. Slope stability analysis. Stability of downstream slope during steady seepage condition. Stability of upstream slope during sudden drawdown condition. Seepage control measures. Measures to control seepage through foundations. Drainage of earth dams. Design of filters. Surface protection of upstream and downstream face of dam. Rockfill dams. Earth core rockfill dams. Design consideration for a rockfill dam. Composite earth-rockfill dam.	8	14	1,2,3,4,5,6	CO4	PSO4			

5	Gravity dam. Basic definition. Forces acting on dams. Load combination for design of a gravity dam. Requirements for stability of gravity dams. Internal stresses and stress concentrations in gravity dams. Design of gravity dam. Elementary profile of gravity dam. Practical profile of gravity dam. Limiting height of low dam. Multistep or zone method of design of gravity dam. Strip method of design of high dams. Joints, keys and water stops. Openings in dams. Galleries.	6	12	1,2,3,4,5,6	CO5	PSO4			
6	Spillways. Essential requirements. Required spillway capacity. Component parts of a spillway. Various types of spillways. Energy dissipation below spillway. Characteristics of a hydraulic jump. Location of hydraulic jump. Measure adopted for dissipation of energy. Stilling basins. Bucket type energy dissipaters. Spillway crests gates. Visvesvaraya gates.	6	12	1,2,3,4,5	CO6	PSO4			
7	Diversion headworks. Location of diversion headworks. Ideal site for a diversion head works. Layout of diversion headworks. Types of weirs. Relative advantages and disadvantages of weirs and barrages. Theories of subsurface flow. Bligh's Creep theory. Lane's weighted creep theory. Potential flow theory. Critical gradient. Khosla's theory. Khosla's solution for a horizontal floor. Khosla's solution for a composite floor. Impervious floor with an intermediate pile. Impervious floor with a downstream pile. Impervious floor with an upstream pile. Exit gradient corrections to superposed values of pressures. Location of hydraulic jump. Water surface profiles. Suction pressure in hydraulic jump through scour due to surface flow.	6	12	1,2,3,4,5,6	CO7	PSO4			
8	Introduction, Requirements of a good distribution system, Arrangement of distribution pipes & other accessories, Layouts of distribution network, Methods of distribution, Pressures in the distribution system, Systems of supply, Design for fixing the sizes of pipes of a simple distribution system, Analysis of complex pipe networks	6	12	1,2,3,4,5,6	CO8	PSO4			

Reference Books

1.	Arora, K. R. "Irrigation, Water Power and Water Resources Engineering". Standard Publishers Distributors, New Delhi.
2.	Creger, W. P., Justin, J. D. and Hind, S. J. "Engineering for Dams Vols. I, II & III". Wiley Eastern Pvt. Ltd., New Delhi.
3.	Design for Small Dams – U.S.B.R.
4.	Garg, S. K. "Irrigation Engineering and Hydraulic Structures". Khanna Publishers, Delhi.
5.	Kushalani, K. B. "Irrigation Engineering: Practice and Design Vol. I to VII". Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6.	Linsley, R. K. and Franzini, J. E. "Water Resources Engineering". McGraw Hill International.
7.	Modi, P. N. "Irrigation Water Resources and Water Power Engineering". Standard Book House, Delhi.
8.	Varshneya, R. S., Gupta, S. C. and Gupta, R. L. "Theory and Design of irrigation structures". Nemchand and Bros., Roorkee.
9.	Garg, S. K. "Water Supply Engineering". Khanna Publishers, Delhi.

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Water Resources Engineering and Management Institute	Academic Year	2025-26

F.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	IV	Core / ~~Elective / Foundation~~ WRE1705LCS : Laboratory Practical	Credits / Hours per week	2P
Semester	I	Year of Introduction: 1991 Year of Syllabus Revision: 2020	Maximum Marks / Grade	50
Mode of Transaction		Laboratory Experiments, discussion and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Area-Elevation Capacity Curve	1	1705LCS	1,2,3,4	CO2	PSO4
2	Zones Of Storage In Reservoir	1	1705LCS	1,2,3,4	CO2	PSO4
3	Topographic Factor For Selection of Dam	1	1705LCS	1,2,3,4	CO3	PSO4
4	Over-Flow & Non-Over Flow Dam	1	1705LCS	1,2,3,4	CO3	PSO4
5	Arch & Butters Dam	1	1705LCS	1,2,3,4	CO3	PSO4
6	Homogeneous Earth Dam	1	1705LCS	1,2,3,4	CO4	PSO4
7	Zoned Earth Dam	1	1705LCS	1,2,3,4	CO4	PSO4
8	Diaphragm Earth Dam	1	1705LCS	1,2,3,4	CO4	PSO4
9	Details of Rock- Toe & Toe-Dam	1	1705LCS	1,2,3,4	CO4	PSO4
10	Components of Gravity Dam	1	1705LCS	1,2,3,4	CO5	PSO4
11	Middle Third Rule	1	1705LCS	1,2,3,4	CO5	PSO4
12	Elementary Profile	1	1705LCS	1,2,3,4	CO5	PSO4
13	Practical Profile	1	1705LCS	1,2,3,4	CO5	PSO4
14	Vertical Drop Weir	1	1705LCS	1,2,3,4	CO6	PSO4
15	Concrete Sloping Weir	1	1705LCS	1,2,3,4	CO6	PSO4
16	Straight Drop Spillway	1	1705LCS	1,2,3,4	CO6	PSO4
17	Ogee Spillway	1	1705LCS	1,2,3,4	CO6	PSO4
18	Chute Spillway	1	1705LCS	1,2,3,4	CO6	PSO4
19	Side Channel Spillway	1	1705LCS	1,2,3,4	CO6	PSO4
20	Shaft Spillway	1	1705LCS	1,2,3,4	CO6	PSO4
21	Volute Siphon Spillway	1	1705LCS	1,2,3,4	CO6	PSO4
22	Locations Of Hydraulic Jumps Case-I JHC & TWRC Coincide Throughout Case-II TWRC Always Lower Than JHC Case-III TWRC Always Higher Than JHC Case-IV TWRC Lower Than JHC At Low Discharges & Higher At High Discharge Case- V TWRC Higher Than JHC At Low Discharge But Lower At High Discharge	4	1705LCS	1,2,3,4	CO6	PSO4

23	Layout of Diversion Head Works	1	1705LCS	1,2,3,4	CO7	PSO4

Syllabus of Courses

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Water Resources Engineering and Management Institute**		**Academic Year**	**2025-26**
F.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)			
Year	**IV**	**Core / ~~Elective / Foundation~~** **WRE1707CS: IRRIGATION ENGINEERING**	**Credits / Hours per week**	**3L**
Semester	**I**	Year of Introduction : 1991 Year of Syllabus Revision : 2020	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1707CS

CO1 To understand various types of surface irrigation systems & its applicability
CO2 To understand various pressurized irrigation system, its applicability and advantages
CO3 To understand basic concept of evaporation and transpiration and its measurement
CO4 To determine on farm irrigation efficiencies to evaluate the system
CO5 To be able to determine referee crop evapotranspiration using various methods and use of software to determine the same
CO6 To be able to determine crop coefficient for determination of crop evapotranspiration
CO7 To be able to understand seasonal crop water requirement & irrigation scheduling
CO8 To be familiar with various types of devices used for flow measurement in open channels

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional

									Ethics (PE)
1	Water application methods : Criteria for selecting water application methods, Surface irrigation methods : border irrigation, Straight and contour borders, Border specifications and stream size, Basin irrigation, Check basin types, Adaptability and basin considerations, Size and shape, Furrow irrigation, Furrow types, Adaptability and characteristics, Straight furrows, Contour furrows, Corrugation irrigation	6	12	1,2	CO1	PSO3 PSO5	Emp/ Ent/SD	L/N/R/G	ES
2	Sub irrigation method : Concept and adaptability, Sprinkler irrigation, Adaptability, Limitations, Sprinkler types, Components of sprinkler system, Drip irrigation, Adaptability, Limitations Drip types, Components of drip system	6	12	1,2	CO2	PSO3 PSO5			
3	Rooting characteristics and moisture use of crops : Evaporation, Transpiration and consumptive use, Measurement of evapotranspiration - (i) Lysimeter experiment, (ii) Field experimental plots, (iii) Soil moisture depletion studies, (iv) Water balance method	6	12	1,2,3	CO3	PSO3 PSO5			
4	Irrigation efficiencies : Efficiencies as per ICID, Water conveyance efficiency, Water application efficiency, Water storage efficiency, Water distribution efficiency, Water use efficiency, Field water use efficiency, Project efficiency, Operational efficiency, Economic efficiency, Water requirement efficiency, Distribution uniformity, Deep percolation ratio and tail water ratio	6	12	1,2,3,4,5,6	CO4	PSO3 PSO5			
5	Estimating reference evapotranspiration from climatological data FAO recommended : (i) Blaney criddle method, (ii) Radiation method, (iii) Penman method, (iv) Modified Penman method, (v) Pan evaporation method and various other methods of estimating potential evapotranspiration. Introduction to CROPWAT, ETo calculator, WEAP software and its applications.	8	14	1,2,3,4	CO5	PSO3 PSO5			
6	Introduction and procedure to calculate crop evapotranspiration (ETc), Crop coefficient approach, Determine single crop coefficient Kc, Kc for different crops for different growth stages, Determining maximum evapotranspiration.	6	12	1,2,3,4	CO6	PSO3 PSO5			
7	Concept of field water balance, Effective rainfall, Ground water contribution and other factors, Net irrigation requirement, Gross irrigation requirement, Estimation of seasonal water requirement using farming practice as Full irrigation, Two irrigation and Rainfed irrigation. Determination of irrigation scheduling using farming practice as Full irrigation, Two irrigation and Rainfed irrigation	8	14	1,2,3,4	CO7	PSO3 PSO5			

8	Flow Measurement, Hydraulic Principles of flow measurements, Factors governing flume selection, Parshall flume, location criteria, cut throat flume. Types of long throated flumes, General equations for rectangular control sections, modular limit, Repogale flume, IT flume. canal flow measurement, Types of metering flumes, Venturi flume and standing wave flume	6	12	1,2,3,4	CO8	PSO3 PSO5			

Reference Books

1.	Design and Operation of Farm Irrigation systems – M.E. Jensen, ASAE Monograph No.3, A.S.A.E. Michigan
2.	Irrigation – Theory and Practice – A. M. Michael, Vikas Publishing House, New Delhi
3.	Irrigation Principles and Practices – V. E. Hansen, C. W. Israelsen and G. E. Stringham, John Wiley and Sons, New York
4.	Advances in Irrigation, Vol. 2 – Daniel Hillel, Academic Press, New York
5.	Surface Irrigation, Theory and Practice – W. R. Walker and G. V. Skogerboe, Prentice Hall Inc., New Jersy
6.	Guidelines for Predicting crop water requirements – J. Doorenbos and W. O. Pruitt Irrig. Drain Pap. 24, FAO, Rome
7.	Yield Response to water – J. Doorenbos and A. H. Kassam Irrig. Drain Pap. 33, FAO, Rome
8.	Crop Evapotranspiration : Guidelines for Computing Crop Requirements, Irrigation and Drainage, Paper No.-56, FAO Rome, Italy – Allen, R. G. Pereila, L.S. Rase, D. Smith, M, (1998)
9.	http://www.fao.org/Land-Water/databases and software
10.	https://www.weap21.org

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Water Resources Engineering and Management Institute	Academic Year	2025-26

F.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	IV	Core / ~~Elective / Foundation~~ WRE1707LCS: Laboratory Practical	Credits / Hours per week	2P
Semester	I	Year of Introduction: 1991 Year of Syllabus Revision: 2020	Maximum Marks / Grade	50
Mode of Transaction		Laboratory Experiments, discussion and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Demonstration of Border Irrigation System	02	1707LCS	1,2,3	CO1	PSO5
2	Demonstration of Basin Irrigation System	02	1707LCS	1,2,3	CO1	PSO5
3	Demonstration of Furrow Irrigation System	02	1707LCS	1,2,3	CO1	PSO5
4	Demonstration of Drip Irrigation System	02	1707LCS	1,2,3	CO2	PSO5
5	Demonstration of Sprinkler Irrigation System	02	1707LCS	1,2,3	CO2	PSO5
6	Determination of ETo by Pan Evaporation	03	1707LCS	1,2,3,4	CO5	PSO5
7	Hands on practice on CROPWAT	03	1707LCS	1,2,3,4	CO5	PSO5
8	Demonstration of ETo Calculator	03	1707LCS	1,2,3,4	CO5	PSO5
9	Demonstration of WEAP	03	1707LCS	1,2,3,4	CO5	PSO5
10	Discharge Measurement by Parshall Flumes	02	1707LCS	1,2,3,4	CO8	PSO5
11	Discharge Measurement by Cut-Throat Flumes	02	1707LCS	1,2,3,4	CO8	PSO5

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Water Resources Engineering and Management Institute**	**Academic Year**	**2025-26**

F.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	**IV**	~~**Core**~~ **/ Elective /** ~~**Foundation**~~ **WRE1708DECS : ELECTIVE I (A) DESING OF IRRIGATION DISTRIBUTION SYSTEM**	**Credits / Hours per week**	**3L**
Semester	**I**	Year of Introduction : 1991 Year of Syllabus Revision : 2020	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1708DECS

CO1 To understand basic terminologies & diagrams of irrigation distribution systems
CO2 To design unlined canals using various theories
CO3 To familiarized with sediment & carry out its estimation using different equations
CO4 To design lined canals using various theories
CO5 To estimate water requirement of crops & prepare L section of canal
CO6 To understand various canal regulation structure along with their design
CO7 To emphasis various C.D. works with respect to different levels & design aqueduct with their drawing
CO8 To study various canal falls & outlet including design & also to understand various flow measuring devices

Unit No.	**Topic**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional (R)/Global (G)	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional

									Ethics (PE)
1	Irrigation canals, Classification and types, Irrigation distribution network, Main canal, Branch canal, Distributary, Minor and water courses, Command areas, Canal alignment, Canals in cutting, full embankment and partial cutting and embankment, Balancing depth of cut, Elements of canal cross section	6	12	1,2,3	CO1	PSO4	Emp/ Ent/SD	L/N/R/G	ES
2	Unlined canals : Non-silting and non-scouring velocity, Kennedy's silt theory, Lacey's regime silt theory, Regime conditions regime equations, Limitations, Design procedures	6	12	1,2,3,4	CO2	PSO4			
3	Concepts of sediment transport, bed load and suspended load, Meyer Peter's and Einstein's equations, Tractive force theory	6	12	1,2	CO3	PSO4			
4	Lined canals : Necessity of canal lining, Types of lining, Economics of canal lining, Selection of lining, Methods of construction, Design of lined canals	6	12	1,2,3,4	CO4	PSO4			
5	Canal capacity : Water requirements by crops, Duty delta concepts, Intensity of irrigation capacity factor, Kor watering etc., Design of network, Longitudinal section, Full supply discharge, Schedule of area and channel dimensions, Concept of AIDO	6	12	1,2,3	CO5	PSO4			
6	Canal structures: Types of structures, Regulation works, Head regulators and cross regulators, Canal escapes functions and design principles	8	14	1,2,3,4	CO6	PSO4			
7	Cross-drainage works, Aqueduct, Syphon, Super passage, Level crossing, Selection and design principles	6	12	1,2,3,4	CO7	PSO4			
8	Canal falls, Necessity and location of canal falls, Various types, roughening devices used in canal falls, Canal outlets, Types of outlet, Criteria's for judging the performance of outlets	8	14	1,2,3,4	CO8	PSO4			

Reference Books

1.	Theory and Design of Irrigation Structures – R. S. Varshney, Gupta and Gupta, Nem chand and Bros., Roorkee
2.	Irrigation and Water Engineering – Punmia and Pando, B. B. Lal – Standard Publishers distributors, Delhi
3.	Fundamentals of Irrigation Engineering – Bharat Singh – Nem chand and bros., Roorkee
4.	Irrigation Engineering and Hydraulics Structures – S.K.Garg
5.	Text book of Irrigation Engineering and Hydraulic Structures – R.K.Sharma, Oxford and ` IBK Publishing house, New Delhi

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Water Resources Engineering and Management Institute	Academic Year	2025-26

F.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	IV	~~Core~~ / Elective / ~~Foundation~~ WRE1708DECS : Laboratory Practical	Credits / Hours per week	2P
Semester	I	Year of Introduction: 1991 Year of Syllabus Revision: 2020	Maximum Marks / Grade	50
Mode of Transaction		Laboratory Experiments, discussion and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Overview of canal and works	5	1708DECS	1,2,3,4	CO1 CO3 CO6 CO7 CO8	PSO4
2	Cross-section of unlined and lined canal	6	1708DECS	1,2,3,4	CO2 CO4	PSO4
3	Longitudinal section of a canal	5	1708DECS	1,2,3,4	CO5	PSO4
4	Design of an aqueduct	5	1708DECS	1,2,3,4	CO7	PSO4
5	Canal fall	5	1708DECS	1,2,3,4	CO8	PSO4

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: BACHELOR OF ENGINEERING (CIVIL - IWM)

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.

PSO2 Analyze and design civil engineering structures and systems which are cost effective, socially acceptable and sustainable.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Department of Applied Mechanics & Structural Engg.**		**Academic Year**	**2025-2026**
B.E. (CIVIL IWM) : UG				
Year	**IV**	**Core / ~~Elective~~ / ~~Foundation~~** **APM1706CS: Design of RCC and Steel structures**	**Credits / Hours per week**	**3L/3 credits** **1 T / 1 credit**
Semester	**I**	Year of Introduction: 2025- 2026 Year of Syllabus Revision:	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials : 3L +1T+2 P		

Course Outcome (CO) APM17XX Students will be able to …

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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill	Relevance to Local (L) / National (N) / Regional (R) / Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and

							Development (SD)	developmental needs	Professional Ethics (PE)
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.	12	20 %	5	CO1 CO2 CO6	PSO1 PSO2	Emp, SD	L, N, R, G	--
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.	11	20 %	5	CO3 CO6	PSO1 PSO2			
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,	12	30 %	5	CO4 CO5	PSO1 PSO2			
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.	10	30 %	6	CO4 CO5	PSO1 PSO2			

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, Prenctice Hall Pub.
6.	Steel Designer's Manual, ELBS Pub.
7.	Steel Structures by T.J. Macginely, 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.

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Mechanics	Academic Year	2025-26

B.E. (CIVIL - IWM) : Regular Programme

Year	IV	Core / ~~Elective~~ / ~~Foundation~~ APM1706LCS: Design of RCC and Steel structures	Credits / Hours per week	01/02
Semester	I	Year of Introduction: 2025-26 Year of Syllabus Revision:	Maximum Marks / Grade	50
Mode of Transaction		Design, Drawings, discussion and viva		

No.	DESIGN and DRAWING	Contact Hours	Weightage %	BT Level	CO	PSO
1	Design of RC framed structure for gravity load (G+2)	5	12	1,2,3	CO1	PS0 1 PSO 2
2	Design of columns and footing	5	12	2,3,4,5	CO6	PS0 1 PSO 2
3	Design of plinth beam and ground beam	5	12	2,3,4,5	CO3	PS0 1 PSO 2
4	Design of floor beam and slab	5	12	2,3,4,5	CO6	PS0 1 PSO 2
5	Design of Plate Girder	5	12	2,3,4,5	CO6	PS0 1 PSO 2
6	Design of steel building	5	12	2,3,4,5,6	CO6	PS0 1 PSO 2

Bloom's Taxonomy Levels: 1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: BE (Civil - IWM)

Programme Specific Outcome (PSO)

PSO1 Demonstrate knowledge and understanding of principles of Civil Engineering and relevant basic sciences by using tools and methodologies to provide application oriented solutions.

PSO 2 Analyse and design civil engineering structures and systems which are cost effective, socially acceptable, and sustainable.

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty of Technology and Engineering Department of Civil Engineering	**Academic Year**	**2025-26**
BE (Civil - IWM): Regular Programme			
Year **IV**	**Core / ~~Elective / Foundation~~ CVL1715CS: Water and Wastewater Enginnering**	**Credits / Hours per week**	**04**
Semester **I**	Year of Introduction: 2025-26 Year of Syllabus Revision:	**Maximum Marks / Grade**	**100**
Mode of Transaction	Lectures and Tutorials		

Course Outcome (CO) CVL1715CS

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	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES),

							Development (SD)		Human Values (HV)and Professional Ethics (PE)
1	Sewage Treatment: fundamentals, Objectives, Unit operations- Dry well, Wet well	1	02	1, 2	CO1	PSO1			
2	Screening, Grit removal: types and design, Sedimentation, Primary Settling Tanks	5	10	2, 3,4	CO1, CO3	PSO1			
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	12	23	2, 3, 4	CO1, CO2	PSO1			
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	11	21	1, 2, 3, 4	CO1, CO3	PSO1, PSO2	Emp, Ent	L, N, R, G	ES
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	9	17	1, 2, 3, 4	CO1, CO3	PSO1, PSO2			
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,	8	15	1,2, 3, 4	CO1 CO3	PSO1, PSO2			

	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	2	04	1, 2	CO4	PSO1 PSO2			
8	Material Balance- Steady state conservative system, steady state system with non-conservative pollutants	4	08	1, 2,3,4	CO5	PSO1 PSO2			

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

	The Maharaja Sayajirao University of Baroda Faculty of Technology and Engineering Department of Civil Engineering	Academic Year	2024-25

BE (Civil -IWM): Regular Programme

Year	IV	Core / ~~Elective / Foundation~~ CVL1715LCS : Termwork	Credits / Hours per week	02
Semester	I	Year of Introduction: 2025-26 Year of Syllabus Revision:	Maximum Marks / Grade	50
Mode of Transaction		Discussion, design project, and viva	PSO1 and PSO2	

No.	Termwork		Course Code	BT Level	CO	PSO
1	Design and detailed engineering drawing of conventional Water treatment plant		CVL1715LCS	3,4,6	CO1, CO2	PSO1, PSO2
2	Design and detailed engineering drawing of conventional Sewage treatment plant		CVL1715LCS	3,4,6	CO1, CO3	PSO1, PSO2

Syllabus of Courses

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Water Resources Engineering and Management Institute**		**Academic Year**	**2025-26**
S.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)			
Year	**IV**	**Core / ~~Elective / Foundation~~** **WRE1805CS : CONSTRUCTION PLANNING AND MANAGEMENT**	**Credits / Hours per week**	**3L**
Semester	**II**	Year of Introduction : 1991 Year of Syllabus Revision : 2021	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1805

CO1 To prepare bar chart, mile stone chart & to carry out network analysis using Critical Path Method
CO2 To carry out PERT analysis, resources allocation & crashing for different projects
CO3 To understand basic fundamentals of vehicles used for earth moving
CO4 To familiarized with various hauling equipments
CO5 To familiar with various excavation & compacting equipments
CO6 To familiarized with pumping & drilling equipments
CO7 To understand different methods of depreciation & to estimate owning & operating cost of different equipment
CO8 To demonstration and to provide Hands-on Practice of MS Project.

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional

									Ethics (PE)
1	Construction planning : Necessity, Methods of planning, Fundamentals terms-events, Activities, Bar charts, Critical path method, Developing critical path network, Statement of work, Workbreak-down structure.	7	13.5	1,2,3,4,5	CO1	PSO1 PSO2 PSO4	Emp/ Ent/SD	L/N/R/G	HV, PE
2	Programme evaluation and review technique (PERT) construction scheduling, Construction cost control, Construction management cost optimisation, Crashing, Resource allocation, Resource smoothening	7	13.5	1,2,3,4,5	CO2	PSO1 PSO2 PSO4			
3	Engineering fundamentals : Rolling resistance, Effect of grade drawbar pull, Rimpull, Acceleration, Swell and shrinkage of soils	7	13.5	1,2,3,4,5	CO3	PSO1 PSO2 PSO4			
4	Tractors and related equipment : Tractors-types, Performance & gradability, Bulldozers types and output tractor shovels rippers, Land cleaning equipment scrapers, Cycle times, Types and output drag line, Clam shells, Hoes, Trenching machines, Farm equipment tractors, ploughs, discharrows	7	13.5	1,2,3,4	CO4	PSO1 PSO2 PSO4			
5	Other construction equipment : Power shovels - types and size, Selection, Optimum depth of cut, Output, Trucks and wagons, Types and capacities, Balancing capacities of excavators, Compacting equipment: Rollers, their suitability for different operations, Belt conveyers component & power required	6	11.5	1,2,3	CO5	PSO1 PSO2 PSO4			
6	Pumping equipment, Types of pumps used in construction work selection, 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 sizes	4	7.5	1,2,3	CO6	PSO1 PSO2 PSO4			
7	Selection of construction equipment : Methods of depreciation cost of owning and operation of equipment cost of maintenance and repairs of construction equipment, Financial management, Discounted cash flow analysis, Present worth	7	13.5	1,2,3	CO7	PSO1 PSO2 PSO4			
8	Demonstration of MS Project. Hands-on Practice of MS Project.	7	13.5						
Reference Books									
1.	Construction Planning, Equipment and Methods - R.C.Peurifoy								
2.	Construction equipment, Planning and applications - Mahesh Verma								
3.	PERT & CPM - L. Srinath								
4.	Critical path methods inconstruction practice – Antia								
5.	Farm Machinery and Equipment - Smith nd Wilkes								
6.	Farm Machinery – Gulfin								

7.	Project Management - Kerzner - Van Nostrand Reinhold Co.

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Water Resources Engineering and Management Institute	Academic Year	2025-26

S.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	IV	Core / ~~Elective / Foundation~~ WRE1805LCS : Laboratory Practical	Credits / Hours per week	2P
Semester	II	Year of Introduction : 1991 Year of Syllabus Revision :2021	Maximum Marks / Grade	50
Mode of Transaction		Field visit,drawing,Analysis, discussion and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Demonstration of Onsite Application of various earth moving vehicle	4	1805LCS	1,2,3	CO4	PSO1 PSO2
2	Demonstration of Onsite Application of various earth excavating machinery	4	1805LCS	1,2,3	CO5	PSO1 PSO2
3	Preparation of Gantt chart for construction of on site residential house	4	1805LCS	1,2,3,4	CO1	PSO1 PSO2
4	Preparation of Gantt chart for construction of Small water resources Project	4	1805LCS	1,2,3,4	CO1	PSO1 PSO2 PSO4
5	To carry out CPM and PERT analysis for on field project data	4	1805LCS	1,2,3,4	CO2	PSO1 PSO2 PSO4
6	Determination of owing and operating cost of an equipments	4	1805LCS	1,2,3,4	CO7	PSO1 PSO2
7	Demonstration of MS Project	6	1805LCS	1,2,3	CO8	PSO1 PSO2 PSO4
8	Hands on practice of MS Project	9	1805LCS	1,2,3, 4,5,6	CO8	PSO1 PSO2 PSO4

Syllabus of Courses

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Water Resources Engineering and Management Institute**		**Academic Year**	**2025-26**
S.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)			
Year	**IV**	**Core / ~~Elective / Foundation~~** **WRE1808CS : DESIGN OF IRRIGATION SYSTEMS**	**Credits / Hours per week**	**3L**
Semester	**II**	Year of Introduction : 1991 Year of Syllabus Revision :	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1808CS

CO1	To study various phases of surface irrigation
CO2	To be able to design and evaluate various components of border irrigation system
CO3	Understanding various components of basin irrigation system, its design and evaluation
CO4	To be familiar with furrow irrigation design & evaluate its components
CO5	Understanding hydraulics of pipe and various equations used for head loss
CO6	To be able to determine head loss in multiple outlet pipes
CO7	To be able to design & evaluate sprinkler irrigation system
CO8	To be able to prepare layout design & evaluation of various components of drip irrigation system

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional

									Ethics (PE)
1	Levis Milne equation, Volume balance field design, Design objectives, Advance phase, Wetting, Depletion phase, Recession phase	6	12	1,2,3	CO1	PSO5	Emp/ Ent/SD	L/N/R/G	ES
2	Design of Border irrigation system, Evaluation of border irrigation system	6	12	1,2,3,4,5	CO2	PSO5			
3	Design of basin irrigation system, Evaluation of basin irrigation system	6	12	1,2,3,4,5	CO3	PSO5			
4	Design of furrow irrigation system, Evaluation of furrow irrigation system	6	12	1,2,3,4,5	CO4	PSO5			
5	Hydraulics of pipe systems, Fundamental flow equations, Darcy-Weisbach equation, Scobey equation and Hagen Williams equation	6	12	1,2,3	CO5	PSO5			
6	Headloss in pipes with multiple, equally spaced outlets	6	12	1,2,3	CO6	PSO5			
7	Design of solid set sprinkler system, Evaluation of sprinkler irrigation system distribution uniformity, Coefficient of uniformity	8	14	1,2,3,4,5	CO7	PSO5			
8	Design of drip irrigation system, Evaluation of drip irrigation system	8	14	1,2,3,4,5	CO8	PSO5			

Reference Books

1.	Design and operation of Farm Irrigation systems - M. E. Jensen ASAE Monograph No.3, ASAE, Michigan
2.	Surface Irrigation Theory and Practice - W. R. Walker and G. V. Skogerboe, Prentice Hall Inc., New Jersey
3.	Farm Irrigation system Evaluation, A guide for Management - J. L. Merriam and Jack Keller, Utah State University, Logan

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Year	IV	Core / ~~Elective / Foundation~~ WRE1808LCS : Laboratory Practical	Credits / Hours per week	2P
Semester	II	Year of Introduction: 1991 Year of Syllabus Revision:	Maximum Marks / Grade	50
Mode of Transaction		Laboratory Experiments, discussion and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Analysis of advance, recession and depletion phases	6	1808LCS	1,2,3	CO1	PSO5
2	Design of border irrigation system	6	1808LCS	1,2,3,4	CO2	PSO5
3	Design of basin irrigation system	6	1808LCS	1,2,3,4	CO3	PSO5
4	Design of furrow irrigation system	6	1808LCS	1,2,3,4	CO4	PSO5
5	Layout and design of drip irrigation system	6	1808LCS	1,2,3,4	CO8	PSO5
6	Layout and design of sprinkler irrigation system	6	1808LCS	1,2,3,4	CO7	PSO5
7	Evaluation of border irrigation system	3	1808LCS	1,2,3, 4,5	CO2	PSO5
8	Evaluation of drip irrigation system	3	1808LCS	1,2,3, 4,5	CO8	PSO5
9	Evaluation of sprinkler irrigation system	3	1808LCS	1,2,3, 4,5	CO7	PSO5
10	Determination of head loss in pipe flow	3	1808LCS	1,2,3	CO5	PSO5
11	Determination of head loss in multiple outlet pipes	4	1808LCS	1,2,3	CO6	PSO5

Syllabus of Courses

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S.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	**IV**	~~**Core**~~ **/ Elective /** ~~**Foundation**~~ **WRE1809DECS : ELECTIVE II (A) DRAINAGE ENGINEERING OF IRRIGATED AGRICULTURE**	**Credits / Hours per week**	**3L**
Semester	**II**	Year of Introduction : 1991 Year of Syllabus Revision :	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1809DECS

CO1 To understand the concept of drainage and its needs and properties
CO2 To be able to understand various types of drainage system & survey & investigations of the same
CO3 To able to design surface drainage systems & its components
CO4 To be able to design sub surface drainage system and its components
CO5 To be familiar with special methods of drainage
CO6 To be familiar with problems in drainage
CO7 To understand problems causes & preventive measures related to drainage
CO8 To understand preventive measures for saline soils

Unit No.	**Topic**	**Contact Hours**	**Weightage (%)**	**BT Level**	**CO**	**PSO**	**Elements of** Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	**Relevance to** Local (L)/ National (N)/ Regional (R)/Global (G)	**Relation to** Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professio

									nal Ethics (PE)
1	Importance and benefits of drainage, Interrelationship of irrigation and drainage, Soil properties influencing drainage, Statics and dynamics of soil water, Hydraulic conductivity and its measurement in the laboratory and the field	6	12	1,2,3,4	CO1	PSO5	Emp/ Ent/SD	L/N/R/G	ES
2	Types of drainage, Surface and subsurface, Drainage surveys and investigations, Types of land requiring drainage and criteria, Planning a field drainage system, Fundamentals of seepage analysis	6	12	1,2,3,4	CO2	PSO5			
3	Surface drainage, Type and design of open ditches	8	14	1,2,3,4	CO3	PSO5			
4	Subsurface Drainage : Theory of subsurface drainage, General solution to drainage flow problems, Flow to drains in homogeneous, Heterogeneous and anisotropic soils, Design of filters, Subsurface drainage design, Types of systems, Depth and spacing design criteria	8	14	1,2,3,4	CO4	PSO5			
5	Maintenance of water table, Special methods of drainage e.g. Vertical drainage, Mole drains, Drainage wells Recycling of drainage water	6	12	1,2,3	CO5	PSO5			
6	Problems related to drainage and salinity in irrigated agriculture, Causes of salt accumulation	6	12	1,2,3	CO6	PSO5			
7	Water logging, Soil salinity, Salt balance, Leaching methods	6	12	1,2,3,4	CO7	PSO5			
8	Reclamation and management of salt affected soils, Reclamation of saline and alkaline soils, Special legal problems of reclamation	6	12	1,2,3	CO8	PSO5			

Reference Books

1.	Drainage manual for irrigated Agriculture in India - IMTP Publication, New Delhi
2.	Drainage Engineering – Luthin
3.	Manual of Surface Drainage Engineering Vol. II - B. Z. Kinori and J. Mevorach - Elseveir
4.	Drainage for Agriculture - J. V. Schilfgaarde - American Society of Agronomy

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Year	IV	~~Core~~ / Elective / ~~Foundation~~ WRE1809LDECS: Laboratory Practical	Credits / Hours per week	2P
Semester	II	Year of Introduction: 1991 Year of Syllabus Revision:	Maximum Marks / Grade	50
Mode of Transaction		Laboratory Experiments, discussion and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Field visit to show agriculture surface drainage system	4	1809LDECS	1,2,3	CO3	PSO5
2	Determination of Runoff by US SCS CN Method	4	1809LDECS	1,2,3	CO3	PSO5
3	Field visit to show agriculture sub surface drainage system	4	1809LDECS	1,2,3	CO4	PSO5
4	Field visit to show water logged area, and their problems	4	1809LDECS	1,2,3	CO7	PSO5
5	Field visit to show salt affected areas and their reclamation	5	1809LDECS	1,2,3	CO7	PSO5
6	Determination of Leaching Requirements	5	1809LDECS	1,2,3	CO7	PSO5

Syllabus of Courses

The Maharaja Sayajirao University of Baroda **Faculty Technology and Engineering** **Water Resources Engineering and Management Institute**		**Academic Year**	**2025-26**
S.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)			
Year	**IV**	**~~Core~~ / Elective ~~/ Foundation~~** **ELECTIVE III - WRE1811DECS : IRRIGATION MANAGEMENT**	**Credits / Hours per week**	**3L**
Semester	**II**	Year of Introduction : 1991 Year of Syllabus Revision : 2020	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1811DECS

CO1 To familiar with various traditional approach of irrigation management
CO2 To understand participatory approach in irrigation management
CO3 To understand management & need of water user association
CO4 To emphasis on the process of training to WUA/WUC, agency officials including their monitoring performance
CO5 To understand various traditional water supply systems & develop RWS scheduling
CO6 To familiar with traditional tank management system with their case studies
CO7 To familiarized with lift irrigation system & its design for water allocation
CO8 To understand integrated approach in water resources management

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional

									Ethics (PE)
1	Goals of irrigation management, Problems in irrigation management, Social scientists and irrigation engineers, joint involvement in management of irrigation systems. Traditional irrigation management	6	12	1,2	CO1	PSO3 PSO5	Emp/ Ent/SD	L/N/R/G	G, ES, HV, PE
2	Participatory Irrigation management, Concept of PIM, Need of PIM, Benefits of PIM, Objectives of PIM, Status of PIM in India and Gujarat, Impacts of PIM, Approaches to PIM, Constraints in implementation on PIM, Support for PIM in India	6	12	1,2,3	CO2	PSO3 PSO5			
3	Water user's association / cooperatives. Pre-requites for sustainable WUA/WUC. Types of farmer's organization. Hierarchy of irrigation dept. and WUA/WUC. Constraints to farmer's participation. Incentives for implementation of PIM. Organizing steps for transfer of management to users. Steps of rehabilitation and maintenance work carried out by WUA/ WUC. Allocation of water. Steps for charging of water within the organization. Agreement of MOU between WUA/ WUC and Government. Formation, rights and functions of each committee. Rights and functions of irrigation department. Raising of funds and investment by WUA/ WUC	8	14	1,2,3	CO3	PSO3 PSO5			
4	Training of PIM to WUA/ WUC. Organizers for implementing PIM. Designing a capacity building program for PIM. Role of trainer. Conducting training programme. Training of discharge measurement. Walk through survey/maintenance survey. Crop assessments and water charges collection. Training to agency officials. Workshops on agricultural production practices. Monitoring performances of WUA/ WUC, Impacts of PIM on irrigation efficiency & equity, Impact of PIM on agriculture	8	14	1,2,3	CO4	PSO3 PSO5			
5	Rotational Water Supply System. Traditional system, Sejpali, Warabandhi, Vara-Varam, RWS, Principles of RWS system, Preparation of RWS.	6	12	1,2,3	CO5	PSO3 PSO5			
6	Tank management systems, Organisation structure, Maintenance schedule, Problems involved, Organisation of rotational schedule, Case studies	6	12	1,2,3	CO6	PSO3 PSO5			
7	Management of lift irrigation system, System design for water allocation, Role of water users' organization in management of lift irrigation systems, Economic appraisal of lift irrigation scheme.	6	12	1,2,3	CO7	PSO3 PSO5			
8	Integrated water resources management. Principles, Key issues in IWRM. Establishing basin management system. Roles and types of basin organizations. Finance. Involving stakeholders. Strategic long term planning. Basin action plans.	6	12	1,2,3	CO8	PSO3 PSO5			

Reference Books

1.	Barik, B. C. “Course Report on Partipatory Irrigation Management”. WALMI, Anand
2.	Guide for Preparation of Plans of Operation and Maintenance of Irrigation Systems in India – Indian National Committee on Irrigation and Drainage, INCID, New Delhi.
3.	Guidelines for “Hariyali” Watershed Development Programme. Ministry of Rural Development, Govt. of India.
4.	Gujarat Government Orders on Participatory Irrigation Management, Development Support Centre, Ahmedabad
5.	Impact of Participatory Irrigation Management Training Programme. WALMI, Anand
6.	Irrigation Management Committees NMWP Guidelines and Implantations for Implementation Indo-Dutch Training, Production Management Unit.
7.	Hooja, R. “A Strategy for training for PIM in India, Working paper, Indianpim.
8.	Maloney, C. and K.V. Raju., “Economic aspect of PIM”, Additional reading on farmers’ organizations for irrigation management, WAPCOS, New Delhi.
9.	Murray, H., Lashri B. and Memon, Y. “How to establish water users association?” Practical steps for social mobilizers”, IWMI
10.	Pangare, G.A. “Scaling up PIM in India”. Indian Network on PIM, New Delhi.
11.	A Handbook for Integrated Water Resources Management in Basins, Published 2009 by the Global Water Partnership (GWP) and the International Network of Basin Organizations (INBO).
12.	Puskar Jena, Mamata Swain, “Participatory Irrigation Management in India”, Best Publishing House
13.	UU.S. Gautam, A. K. Singh, A. K. Sikka, “Participatory Irrigation Management”, Agrotech Publishing Agency

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S.S. OF B.E.-IV (CIVIL – IRRIGATION WATER MANAGEMENT)

Year	IV	Core / ~~Elective / Foundation~~ WRE1811LDECS : Laboratory Practical	Credits / Hours per week	2P
Semester	II	Year of Introduction: 1991 Year of Syllabus Revision:2020	Maximum Marks / Grade	50
Mode of Transaction		Laboratory Experiments, Field Visit and viva		

No.	Experiment	Contact Hours	Course Code	BT Level	CO	PSO
1	Field visit to Water User's Association to discuss rights and functions of each committee of WUA and PIM	5	1811LDECS	1.2.3	CO3	PSO3 PSO5
2	Field visit to co-operative societies to discuss rights and functions of PIM	5	1811LDECS	1.2.3	CO2 CO4	PSO3 PSO5
3	Preparation of RWS based on actual schedule	5	1811LDECS	1.2.3	CO5	PSO3 PSO5
4	Field visit to Tank Irrigation system and understand its components, functions and management	5	1811LDECS	1.2.3	CO6	PSO3 PSO5
5	Field visit to Lift Irrigation System and understand system design for water allocation and its management.	6	1811LDECS	1,2,3	CO7	PSO3 PSO5

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Year	**IV**	**Core / ~~Elective / Foundation~~** **WRE1813LCS : DESIGN PROJECT (WATER RESOURCES ENGINEERIG)**	**Credits / Hours per week**	**4P**
Semester	**I**	Year of Introduction : 1991 Year of Syllabus Revision :	**Maximum Marks / Grade**	**100**
Mode of Transaction		Lectures and Tutorials		

Course Outcome (CO) WRE1813LCS

CO1 The students will be able to carry out a project and also to document in form of a report based on the work. They are also encouraged to present using latest techniques enabling them to improve their presentation.

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Analysis, Design, computer Applications, care studies, feasibility study or state of the Art study on any topic related to Water Resources Engineering. A project report is to be prepared and viva voce will be based on the project work done by the students.	52	100	1,2,3,4,5,6	CO1	PSO3 PSO4 PSO5	Emp/ Ent/SD	L/N/R/G	ES, HV, PE