SYLLABUS

(With effect from 2023 -24)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕ ವರ್ಷ 2023-24)

**Bachelor Degree
In
Civil Engineering**

III & IV Semester

Out Come Based Education
With
Choice Based Credit System

[National Education Policy Scheme]

P.E.S. College of Engineering, Mandya - 571 401, Karnataka

*[An Autonomous Institution affiliated to VTU, Belagavi,
Grant – in – Aid Institution (Government of Karnataka),
Accredited by NBA (All UG Programs), NAAC and Approved by AICTE, New Delhi]*

**ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ
ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ
(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)**

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VISION

"PESCE shall be a leading institution imparting quality Engineering and Management education developing creative and socially responsible professionals."

MISSION

➢ *Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.*

➢ *Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.*

➢ *Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.*

➢ *Promote research, product development and industry-institution interaction.*

QUALITY POLICY

Highly committed in providing quality, concurrent technical education and continuously striving to meet expectations of stake holders.

CORE VALUES

Professionalism
Empathy
Synergy
Commitment
Ethics

DEPARTMENT OF CIVIL ENGINEERING

The Civil Engineering Department was started in the year 1962 as one of the first branches in P.E.S. College of Engineering, Mandya with an intake of 40. The department has carved a niche for itself by offering the most competent instructional programs to the students. The department is running an undergraduate programme with an intake of 120 and it has started PG in CAD Structures with an intake of 18 in the year 2006. The department has been recognized as research centre under VTU, Belgaum. The department is accredited by NBA, New Delhi for five years (2004-2009). The department is well equipped with laboratories, computing facilities, independent library and other infrastructure. The department has well qualified and experienced teaching faculties. The department also takes up consultancy work pertaining to planning, structural designs of buildings, testing of materials, soil investigation.

Vision

To attain Excellence in imparting quality civil engineering education to meet the societal needs.

Mission

- Impart civil engineering and managerial skills with state of art infrastructure, competent and committed faculty using outcome based educational curriculum.

- Promote research, project management and consultancy

- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.

The Program Educational Objectives (PEOs)

- Apply technical competence in the field of Civil Engineering with a strong background in basic science and mathematics.

- Analyse and interpret data to design or evaluate civil engineering systems to satisfy societal needs with the use of modern tools including higher education.

- Function effectively as an individual and or to work in a team on multispecialized civil engineering projects with professional ethics and effective communication skills inculcating the habit of life-long learning.

Program Specific Outcomes (PSOs)

The Program specific outcomes have been derived from the PSC's defined by ASCE. By the time of graduation, Civil Engineering students will be able to

PSO1: Apply knowledge of basic science to analyze and solve problems in the core area of Civil Engineering such as Structural, Geotechnical, Transportation, Environmental, Hydraulics and Water resources engineering.

PSO2: Analyse, Plan, design, quality assessment and cost estimate of Civil Engineering structures with professional ethics.

PSO3: Work in a consulting organization or can be an entrepreneur to investigate and supervise Civil Engineering structures using modern tools and technology to provide sustainable solutions to meet the societal needs.

Programme Outcomes (PO)

Engineering program must demonstrate that their students attain the following outcomes:

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

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

3. **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.

4. **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.

5. **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.

6. **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.

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

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

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

10. **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.

11. **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.

12**. 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.

Sl. No.	Course Code	Course Title	Teaching Department	L	T	P	Credits	CIE	SEE	Total
		Bachelor of Engineering (III –Semester)			Hrs / Week			Examination Marks		
1	P22MA301	Transforms and Series	MA	2	2	-	3	50	50	100
2	P22CV302	Building Materials and Construction	CV	3	-	-	3	50	50	100
3	P22CV303	Concrete Technology	CV	3	-	-	3	50	50	100
4	P22CV304	Fluid Mechanics & Hydraulics	CV	3	-	2	4	50	50	100
5	P22CV305	Strength of Materials	CV	3	-	2	4	50	50	100
6	P22CVL306	Computer Aided Building Planning and Drawing	CV	-	-	2	1	50	50	100
7	P22HSMC307	Employability Enhancement Skills - III	HSMC	-	2	-	1	50	50	100
8	P22BFE308	Biology For Engineers	CV	2	-	-	2	50	50	100
9	P22NSS309	National Service Scheme (NSS)	NSS coordinator	-	-	2	0	100	-	100
	P22PED309	Physical Education (PE) (Sports and Athletics)	PED							
	P22YOG309	Yoga	YOGA							
		Total					**21**			

| 10 | P22MDIP301 | Additional Mathematics – I | MA | 2 | 2 | - | 0 | 100 | - | 100 |
| 11 | P22HDIP307 | Additional Communicative English - I | HSMC | - | 2 | - | 0 | 100 | - | 100 |

Sl. No.	Course Code	Course Title	Teaching Department	L	T	P	Credits	CIE	SEE	Total
		Bachelor of Engineering (IV –Semester)			Hrs / Week			Examination Marks		
1	P22MA401A	Applied Mathematical Methods	MA	2	2	-	3	50	50	100
2	P22CV402	Analysis of Structures	CV	3	-	-	3	50	50	100
3	P22CV403	Hydrology and Irrigation Engineering	CV	3	-	-	3	50	50	100
4	P22CV404	Geodetic Engineering (Integrated)	CV	3	-	2	4	50	50	100
5	P22CV405	Public Health Engineering (Integrated)	CV	3	-	2	4	50	50	100
6	P22CVL406	Concrete and Non-Destructive Testing Laboratory	CV	-	-	2	1	50	50	100
7	P22HSMC407A	Employability Enhancement Skills - IV	HSMC	-	2	-	1	50	50	100
8	P22INT408	Internship – I	CV	-	-	-	2	-	100	100
9	P22NSS409	National Service Scheme (NSS)	NSS coordinator	-	-	2	0	100	-	100
	P22PED409	Physical Education (PE) (Sports and Athletics)	PED							
	P22YOG409	Yoga	YOGA							
		Total					**21**			

| 10 | P22MDIP401 | Additional Mathematics – II | MA | 2 | 2 | - | 0 | 100 | - | 100 |
| 11 | P22HDIP407 | Additional Communicative English - II | HSMC | - | 2 | - | 0 | 100 | - | 100 |

L –Lecture, T – Tutorial, P- Practical/ Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination

TRANSFORMS AND SERIES
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – III

Course Code:	P22MA301	Credits:		03
Teaching Hours/Week (L:T:P):	2-2-0	CIE Marks:		50
Total Number of Teaching Hours:	40	SEE Marks:		50

Course Learning Objectives:

1	**Understand** the concept of infinite series; learn and apply Fourier series to represent periodical physical phenomena in engineering analysis.
2	To facilitate students to study, analyse and apply various transforms to solve engineering problems.

Unit	Syllabus content	No. of hours	
		Theory	Tutorial
I	**Infinite Series:** Introduction, convergence, divergence and oscillation of a series, Tests for convergence – Comparison test, Ratio test, Cauchy's root test Raabe's test, (All tests without proof)- Problems. **Self-study component:** Integral Test, Alternating series, Leibnitz's theorem – absolute and conditional convergence.	06	02
II	**Fourier Series:** Introduction, periodic function, even and odd functions, Dirichlet's conditions, Euler's formula for Fourier series (no proof). Fourier series for functions of arbitrary period of the form 2L (all particular cases) – problems, analysis- Illustrative examples from engineering field. Half Range Fourier series- Construction of Half range cosine and sine series and problems. Practical harmonic analysis- Illustrative examples from engineering field. **Self study**: Complex Fourier series.	06	02
III	**Laplace Transforms**: Definition – Transforms of elementary functions. Properties of Laplace Transforms- linearity, Change of scale, shifting, Transform of Derivative and Integrals, Transform of a function multiplied by t^n and division t (no proof)-Problems, Transforms of periodic function, unit step function (All results without proof)-Problems only. Inverse Laplace Transforms: Evaluation of inverse transforms by standard methods. Convolution theorem - Problems only. **Self-study component**- Transform of Unit impulse function. Solution of ODE by Laplace method and L-R-C circuits.	06	02
IV	**Fourier Transforms**: **Complex Fourier Transform**: Infinite Fourier transforms and Inverse Fourier transforms. Properties of Fourier Transforms- linearity Change of scale, shifting and modulation (no proof)- Problems, Fourier sine and cosine transforms and Inverse Fourier cosine and sine transforms with properties-Problems Convolution theorem and Parseval's identity for Fourier Transform (no proof)-problems. **Self study**: Fourier integrals- Complex forms of Fourier integral.	06	02

V	**Z-Transforms**: Definition. Some standard Z-transforms. Properties-linearity, Damping, Shifting, multiplication by *n*, initial and final value theorem-problems. Evaluation of Inverse Z- transforms- problems. **Application to Difference Equations**: Solutions of linear difference equations using Z- transforms. **Self study**: Convolution theorem and problems, two sided Z-transforms.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:	
CO1	**Understand** the fundamental concepts of infinite series, transforms of functions
CO2	**Apply** series and transform techniques to obtain series expansion, discrete and continuous transformation of various mathematical functions.
CO3	**Analyze** various signals using series expansions and differential, integral and difference equations using transforms
CO4	**Evaluate** indefinite integrals, differential equations and difference equations subject to initial conditions using transforms and develop series for a discontinuous function

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXT BOOKS
1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS
1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education, 11th Ed.,
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International Publishing House Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES
1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/
4. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/
5. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/differential-equations/first-order-differential-equations/

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	3										
CO3	3	2										
CO4	2	3										
Strength of correlation: Low-1, Medium- 2, High-3

BUILDING MATERIALS AND CONSTRUCTION
[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	**P22CV302**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3: 0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Explain different types of construction materials.
- Classify bonds in brick work, shoring, underpinning and types of flooring.
- Explain different types of roofs, stairs, doors, windows and ventilators.
- Explain purpose of plastering and methods of plastering, painting and finishes.

UNIT – I	**Building Materials**	**08 Hours**

Qualities of good building stones, dressing of stones, classifications of bricks, manufacture of bricks, qualities of good bricks, types of concrete blocks, Concept of aerated concrete blocks, types of tiles, qualities of good tiles & its uses, Classifications of timber as per Indian standards. Defects in timber, seasoning of timber, plywood and its uses.

Self-study component:	The students shall visit construction sites and learn to identify different types of building stones, bricks, stabilized mud blocks, concrete blocks. They shall visit timber depot and learn to identify different types of wood. Innovative methods of use of waste plastic blocks and tests on different types of blocks, also acceptance criteria as per codal provisions.

UNIT – II	**Foundation**	**08 Hours**

Preliminary investigation of soil, bearing capacity of soil, safe bearing capacity of soil, methods of determining bearing capacity, methods of improving bearing capacity. Concept of foundation, classification of foundations, Introduction to different types of foundations, masonry footings - basic numerical problems, isolated footings, combined and strap RCC footings, raft footing, foundation in black cotton soil (or expansive soil) .

Self-study component:	The students shall visit construction sites and learn to identify different types of foundations and details of super structures.

UNIT – III	**Masonry, Arches and Floors**	**08 Hours**

Masonry: Definition of terms used in masonry, bonds in brickwork, English bond, Flemish bond, reinforced brickwork, stone masonry, rubble masonry, coursed rubble masonry, composite masonry.
Arches: Masonry arches, classification, lintels, types and classifications, shoring, underpinning.
Floors: Types of flooring (materials and method of laying), mosaic, marble, polished granite, industrial flooring, vitrified flooring.

Self-study component:	Rattrap bond, factors affecting selection of flooring materials, epoxy flooring, Advances in flooring.

UNIT – IV	**Roofs, Stairs, Doors and Windows**	**08 Hours**

Roofs: Sloped roof (R.C.C. and tile roof), lean to roof, wooden truss (King post and Queen post trusses) steel trusses.

Stairs: technical terms in stairs, requirements of a good stair, geometric design of RCC dog legged and open well stairs. (Plan and sectional elevation of stairs),

Doors and Windows: Doors, paneled doors, flush doors, collapsible and rolling shutters, Types of windows- paneled, glazed, bay window, dormer window, louvered and corner window, ventilators

Self-study component:	Fixtures and fastenings, National Building Code, UPVC & Alluminum Windows.

UNIT – V	Plastering, Painting and Finishes	08 Hours

Plastering and painting: Purpose of plastering, materials of plastering, lime mortar, cement mortar, Ready mix mortar, methods of plastering, stucco plastering, Purpose of painting, types of paints, Introduction to VOC (Volatile Organic Compounds), application of paints to new surfaces, distemper, plastic emulsion, enamel, painting on iron and steel surfaces. Polishing of wood surface.

Finishes: Structural glazing, cladding & its types, architectural punning.

Miscellaneous topics: Water proofing, form work & scaffolding.

Self-study component:	Slip forming and damp proof construction.

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	**Identify** the preliminary requirements of building materials **(PO1, PO2, PSO1).**	Applying	L3
CO2	**Analyze** the different components of sub and super structures **(PO1, PO2, PSO1, PSO2).**	Analyzing	L4
CO3	**Examine** the concept of plastering, painting and finishes. **(PO1, PO2, PSO1, PSO2).**	Analyzing	L4
CO4	**Analyze** the concept of water proofing and form work. **(PO1, PO2, PSO1, PSO2).**	Analyzing	L4

Text Book(s):

1. B.C. Punmia, "Building Construction", 10th Edition, Laxmi Publications, New Delhi, 2007.
2. Sushil Kumar S, Building Construction, 20th Edition, Standard Publisher.
3. S. K Duggal, "Building Materials" 4th Edition, New Age International Publishers.

Reference Book(s):

1. P.C. Varghese. "Building Construction", Prentice Hall of India, New Delhi, 2007
2. W B Mackay, "Building Construction" Vol. 4, Pearson Publications.
3. Chudley "Construction Technology", 4th Edition. Pearson Publications.
4. Barry, "Construction of Buildings", 7th Edition, Wiley-black well Publications.
5. National Building Code, BIS, New Delhi.
6. S.C Rangwala., "Engineering Materials", 28th Edition, Charotar Publishing House, Anand, 1997.

Web and Video link(s):

1. Footings: https://www.youtube.com/watch?v=s6E2t_kW57M
2. Cost effective construction: https://www.youtube.com/watch?v=PmX0npteV3c
3. Arches: https://www.youtube.com/watch?v=2RZKK4LhUas
4. Flooring Association of India

E-Books/Resources:

• https://www.sciencedirect.com/journal/construction-and-building-materials

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
COURSE ARTICULATION MATRIX **(BUILDING MATERIALS AND CONSTRUCTION – P22CV302)**															
CO1	2	3											2		
CO2	2	2											2	2	
CO3	2	2											2	2	
CO4	2	3											2	2	
3 – HIGH, 2 – MEDIUM, 1 - LOW															

CONCRETE TECHNOLOGY			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – III			
Course Code:	P22CV303	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	3:0:0	**CIE Marks:**	**50**
Total Number of Teaching Hours:	40	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

1. Cite the basic knowledge of science and engineering of concrete properties related to civil engineering problems.
2. Distinguish between coarse aggregate & fine aggregate and their properties.
3. Understand workability and its effects on strength of concrete.
4. Understand durability of hardened concrete
5. Describe chemical admixtures and mineral admixtures.
6. Explain hardened concrete and its strength properties.

UNIT – I	CEMENT AND AGGREGATES	08 Hours

CEMENT - chemical composition, physical and chemical properties, hydration of cement, manufacture of OPC with flow charts (Dry process), types of cement, tests on cement.

AGGREGATES: Fine aggregate – sieve analysis, specify gravity, bulking, moisture content, deleterious materials. Coarse aggregate – importance of size, shape and texture. Grading of aggregates - sieve analysis, specific gravity, flakiness and elongation index, crushing, impact and abrasion tests.

Self-study component:	Study of Cement test certificate, Deleterious materials

UNIT – II	ADMIXTURES & MIX DESIGN PROCEDURE	08 Hours

ADMIXTURES: Definition, Classification, Chemical admixtures – Plasticizers (action of plasticizers), Super Plasticizers, Accelerator, Retarders.

Mineral admixtures – Fly Ash, Blast Furnace Slag, Meta-Kaolin, GGBS, Rice husk ash.

MIX DESIGN PROCEDURE: Concept of Concrete Mix design, variables in proportioning, exposure conditions, Procedure of mix design (with admixture and without admixture) as per IS10262-2019, Numerical examples of Mix Design.

Self-study component:	Highlights of other methods of Mix Design as per other codes, Silica fume

UNIT – III	FRESH PROPERTIES OF CONCRETE	08 Hours

PROCESS OF MANUFACTURE OF CONCRETE – Batching, Mixing, Transporting, Placing, Compaction, Curing Of Concrete - need and Types of curing. Workability – Definition, Factors Affecting Workability, Measurement Of Workability By Slump, Compaction Factor, Vee-Bee Consistometer tests, Kelly ball test, Segregation and bleeding.

Self-study component:	Accelerated curing.

UNIT – IV	HARDENED CONCRETE	08 Hours

HARDENED CONCRETE: Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, bond strength- aggregate - cement bond strength. Assessment of compressive strength, tensile strength, and modulus of elasticity.

NON-DESTRUCTIVE TESTING OF CONCRETE - Rebound hammer, Ultra Sonic Pulse Velocity test, Cover meter test.

Self-study component:	Other NDT methods- Penetration & Pull out test

UNIT – V	DURABILITY	08 Hours

DURABILITY - Definition, significance of durability. Shrinkage - plastic shrinkage and drying shrinkage, Factors affecting shrinkage. Creep – Measurement of creep, factors affecting creep, effect of creep

Permeability of concrete, chemical attack, Sulphate attack, acid attack, efflorescence, corrosion in concrete, Thermal effect of concrete - thermal conductivity, thermal diffusivity, specific heat

Factors contributing to cracks in concrete - plastic shrinkage, settlement cracks.

Self-study component:	Construction joints and Expansion joints.

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	*Analyse* and infer various properties of cement, cementitious materials, Fine and coarse aggregate asper codal provision and specifications. **(PO1, PSO1)**	Analyzing	L4
CO2	*Design* the concrete mix for the given materials as per IS:10262-2019 provisions. **(PO3, PSO2)**	Create	L6
CO3	*Examine* the manufacturing process and the quality of green concrete and the role of admixtures in concrete. **(PO2, PSO1)**	Analyzing	L4
CO4	*Analyse* the properties of hardened concrete – Strength and Durability aspects. **(PO2, PSO2)**	Analyzing	L4

Text Book(s):

1. M.S. Shetty, "Concrete Technology" - Theory and Practice, S.Chand and Company, New Delhi, 2002.
2. Gambhir B L, Concrete Technology, Tata McGraw Hill, New Delhi.

Reference Book(s):

1. Neville, A M, Properties of concrete, ELBS Publications.
2. N. KrishnaRaju, Concrete Mix Design -, Sehgal - publishers
3. IS: 10262-2016 – Recommended guidelines for Concrete Mix design – BIS Publications.
4. Mehta PK, Properties of Concrete, ICI, Chennai
5. Concrete Technology (Trade, Technology &Industry), George White, Delmar Pu
6. Concrete: Microstructure, Properties, and Materials, P. Kumar Mehta , Paulo J. M. Monteiro, McGraw-Hill Education
7. A.R.Santakumar , Concrete Technology–Oxford University Press (2007)
8. Advanced Concrete Technology, Zongjin Li, Wiley:1 edition
9. Concrete Admixtures Handbook, Second edition by V.S Ramachandra.

Web links and Video Lectures (e-Resources):

Cement: https://nptel.ac.in/courses/105102012/1

Aggregates: https://nptel.ac.in/courses/105102012/6

Mineral admixtures: https://nptel.ac.in/courses/105102012/11

Chemical admixtures: https://nptel.ac.in/courses/105102012/9

https://nptel.ac.in/courses/105102012/10

Concrete mix design: https://nptel.ac.in/courses/105102012/14

Concrete production & fresh concrete: https://nptel.ac.in/courses/105102012/19

Engineering properties of concrete: https://nptel.ac.in/courses/105102012/23

Dimensional stability & durability: https://nptel.ac.in/courses/105102012/27

Durability of concrete: https://nptel.ac.in/courses/105102012/31

Special concretes: https://nptel.ac.in/courses/105102012/36

E-Books/Resources

https://archive.nptel.ac.in/courses/105/106/105106176/

https://archive.nptel.ac.in/courses/105/102/105102012/

COURSE ARTICULATION MATRIX
(CONCRETE TECHNOLOGY – P22CV303)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2		
CO2			1											2	
CO3		2											2		
CO4		2												1	

3 – HIGH, 2 – MEDIUM, 1 - LOW

FLUID MECHANICS AND HYDRAULICS

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	P22CV304	**Credits:**	04
Teaching Hours/Week (L:T:P):	3:0:2	**CIE Marks:**	50
Total Theory Teaching Hours:	40	**SEE Marks:**	50
Total Laboratory Hours:	24		

Course Learning Objectives: This course will enable the students to:

- To gain knowledge on basic properties of fluid and their applications in engineering field.
- Explain the concepts and theories used in the fluid flow problems and to apply the concepts in real world.
- Establish the relationship among the variables involved in the physical problem by dimensional analysis.
- Understand the losses in pipes, quantifying discharge through notches and weirs.
- Working principles and the design criteria of various turbines and pump.

UNIT – I	**Fluid Properties, Pressure Measurements and Hydrostatics**	**8 Hours**

Fluid Properties: Definition of fluid, classification of fluids. Fluid Properties - Mass density, Specific volume, Specific weight, Relative density, Viscosity, Bulk Modulus & Compressibility, Surface tension, Capillarity. Engineering problems.

Fluid Pressure Measurements: Pascal's Law, Hydrostatic Law, Measurement of pressure using Manometers, Numerical Problems on Manometers.

Hydrostatics: Definition of total pressure, center of pressure, centroid. Equation for hydrostatic force and depth of center of pressure on vertical and Inclined plane surfaces. Engineering applications and problems.

Self-study component:	Total pressure and centre of pressure on curved plane surfaces.
Practical Topics: (6 Hours)	a. Determination of C_d for Venturimeter & Orificemeter. b. Determination of Hydraulic coefficients of a vertical orifice.

UNIT – II	**Fluid Kinematics and Fluid Dynamics**	**8 Hours**

Fluid Kinematics: Description of fluid flow, Lagrangian and Eulerian approaches, classification of flow, continuity equation, derivation of continuity equation in differential form, Numerical problems on continuity equation.

Fluid Dynamics: Derivation of Euler's equation and Bernoulli's equation with assumptions and limitations. Modification of Bernoulli's equation. Application of Bernoulli's equation – Venturimeter, Orificemeter and pitot tube. Engineering applications and problems.

Self-study component:	Velocity and Stream functions, Flow nets.
Practical Topics: (6 Hours)	a. Determination of Major Losses in pipes. b. Determination of Minor Losses in pipes.

UNIT – III	**Losses in Pipes and Flow Measurements**	**8 Hours**

Losses in Pipes: Concept of H.G.L, T.E.L. Equation for head loss due to friction (Darcy-Weisbach equation), Numerical Problems. Minor losses (types and equations only). Pipes in series, pipes in parallel and equivalent pipe. Numerical problems.

Flow Measurements: Classification of Orifice and Mouthpiece, Hydraulic co-efficients. Numerical problems. Classification of Notches and Weirs, discharge over rectangular notch, Triangular notch and Broad crested weir. Engineering applications and problems.

Self-study component:	Water Hammer, Pipe network, Ventilation of weirs.
Practical Topics: (4 Hours)	a. Determination of C_d for Rectangular and Triangular Notch. b. Determination of C_d for Ogee and Broad crested Weir.

UNIT – IV	Dimensional Analysis and Impact of Jet on Vanes	8 Hours

Dimensional Analysis: Introduction to dimensional analysis, units and dimensions, Dimensional homogeneity, Dimensions for various physical quantities. Methods of dimensional analysis - Raleigh's and Buckingham's method. Engineering applications and problems.

Impact of Jet on Vanes: Impulse Momentum equation, Impact of jet on stationary and moving vanes. (Single vane - vertical and curved vanes only), Numerical problems. Impact of jet on series of Flat vanes.

Self-study component:	Model analysis, Impact of jet on series of radially curved vanes.
Practical Topics: (4 Hours)	a. Determination of force excreted by a jet on flat & curved vanes. b. Determination of efficiency of Pelton wheel turbine.

UNIT – V	Hydraulic Turbines and Centrifugal Pumps	8 Hours

Hydraulic Turbines: General layout of a hydroelectric power plant, Classification of turbines. Construction & Working Principle of Pelton wheel & Francis turbine. Numerical Problems. Unit quantities of a turbine-definitions, equations, Engineering applications and problems.

Centrifugal Pumps: Definition, Classification of Pumps, components of centrifugal pump, work done and efficiencies of a centrifugal pump, Minimum starting speed, multistage centrifugal pumps. Numerical problems on centrifugal pumps.

Self-study component:	Characteristic curves of Hydraulic turbines, Cavitation in centrifugal pumps.
Practical Topics: (4 Hours)	a. Determination of efficiency of Francis / Kaplan turbine. b. Determination of efficiency of Centrifugal pump.

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	**Apply** the concepts of fluid flow in **understanding** fluid mechanics and hydraulic machines. **(PO1, PSO1)**	Applying	L3
CO2	**Analyze** and **identify** the various types of flows and their relationships in computing the discharge through pipes, notches and weirs. **(PO2, PSO2)**	Analyzing	L4
CO3	**Design** the Hydraulic turbines and centrifugal pump. **(PO3, PSO2)**	Creating	L6
CO4	**Investigate** the various fluid flow concepts by **conducting** experiments. **(PO4, PSO3)**	Analyzing / Evaluating	L5
CO5	Conduct experiments in a **team or as an individual** having impact for **lifelong learning**. **(PO9, PO12, PSO3)**	Creating	L6

Text Book(s):

1. R.K. Bansal- A text book of Fluid Mechanics and Hydraulic Machines- Laxmi Publications, 10th Edition, New Delhi.
2. P.N. Modi and S.M. Seth- Hydraulics and Fluid Mechanics, including Hydraulic machines, Standard Book House, 22nd Edition, New Delhi.
3. K Subramanya- Fluid Mechanics and Hydraulic Machines, Problems and Solutions, Tata McGrawhill, 2nd Edition, New Delhi.

Reference Book(s):

a. SC Gupta: Fluid Mechanics and Hydraulic Machines – Pearson Education, 1st Edition, India.
b. K R Arora: Hydraulics and Fluid Mechanics, Standard Book House, 1st Edition, New Delhi, India.
c. Victor L. Streeter, Benjamin Wyile E and Keith W. Bedford- Fluid Mechanics, Tata McGraw Hill publishing Co Ltd, 9th Edition, New Delhi.
d. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Publication, 2010.

Web and Video link(s):

1. Properties of Fluid: https://youtu.be/-d67xfgJV98
2. Hydrostatics: https://youtu.be/lJSUeEqGNY0
3. Application of Bernoulli's equation: https://youtu.be/dlsMHsM2V88
4. Losses in pipe fittings: https://youtu.be/pZh5_AWvBuU
5. Dimensional Analysis: https://youtu.be/zr15T9DUlwU

E-Books/Resources:

- https://searchworks.stanford.edu/view/10496310
- https://searchworks.stanford.edu/view/13576277
- https://searchworks.stanford.edu/view/11842972

COURSE ARTICULATION MATRIX
(FLUID MECHANICS & HYDRAULIC MACHINES – P22CV304)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2		2											2		
CO3			2											2	
CO4				2											2
CO5									2			1			2
3 – HIGH, 2 – MEDIUM, 1 - LOW															

STRENGTH OF MATERIALS			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – III			
Course Code:	**P22CV305**	**Credits:**	**04**
Teaching Hours/Week (L:T:P):	3:0:2	**CIE Marks:**	**50**
Total Theory Teaching Hours:	40	**SEE Marks:**	**50**
Total Laboratory Hours:	24		

Course Learning Objectives: This course will enable the students:

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse and quantify different internal forces and stresses induced due to various types of load on structural elements.
4. To calculate and understand the nature of deformations in structural elements subjected to various types of loads and boundary conditions.

UNIT – I	**8 Hours**

Simple stress and strain: Introduction, Properties of Materials, Stress, Strain, Hook's law, and Poisson's ratio, stress - strain curve for ductile and brittle materials- elastic limit, yield point, ultimate strength, working stress and factor of safety, Principle of super position. Elongation of uniform bar, tapering bars of circular and rectangular cross sections subjected to external loads. Elongation of uniform bar due to self-weight.

Elastic constants and relationship between them. Volumetric strain, Expression for volumetric strain.

Compound bars subjected to external loads.

Thermal stresses and strains in uniform bars and compound bars.

Numerical problems on relevant topics.

Self-study component:	Stress – strain curve for High Yield strength Bars including salient features
Practical Topics: **(6 Hours)**	1. Tension test on HYSD bars. 2. Compression test on mild steel & cast iron.

UNIT – II	**8 Hours**

Compound stresses: Introduction, General two dimensional stress system, Normal stress and tangential stress on an inclined plane in a general 2-D stress system, Principal planes and principal stresses. Maximum shear stresses and their planes in 2-D stress system. Mohr's circle of stresses. Numerical Problems.

Thin cylinders: Introduction: Longitudinal, circumferential (hoop) stress in thin cylinders. Expressions for longitudinal and circumferential stresses. Efficiency of longitudinal and circumferential joints. Problems on estimation of change in length, diameter and volume when the thin cylinder subjected to internal fluid pressure.

Thick cylinders: Concept of Thick cylinders Lame's equations applicable to thick cylinders with usual notations, calculation of longitudinal, circumferential and radial stresses – simple numerical examples. Sketching the variation of radial stress (pressure) and circumferential stress across the wall of thick cylinder.

Self-study component:	Thin cylinders with hemispherical ends.	
Practical Topics: (6 Hours)	Hardness tests on ferrous and non-ferrous metals by, 1.Brinell's Hardness test 2.Rockwell Hardness test 3. Vickers Hardness test.	
UNIT – III		**8 Hours**

Bending moment and shear force diagrams in beams: Definition of shear force and bending moment, Sign convention, Relationship between loading, shear force and bending moment, development of Shear Force Diagram(SFD) and Bending Moment Diagram (BMD) with salient values for cantilever, simply supported and overhanging beams for point loads, UDL(Uniformly Distributed Load), UVL(Uniformly Varying Load) and Couple.

Deflection of determinate beams: Introduction, Elastic curve, differential equation of deflection curve, sign convention, determination of Slope and deflection using Macaulay's method for statically determinate beams subjected to various vertical loads, moment and their combinations. Numerical problems.

Self-study component:	SFD and BMD for beams with internal hinges.	
Practical Topics: (4 Hours)	1. Bending test on wood under two-point loading. 2. Tests on bricks	
UNIT – IV		**8 Hours**

Bending stress in beams: Introduction – Bending stress in beam, Pure bending, Assumptions in simple bending theory, derivation of Simple bending equation (Bernoulli's equation), modulus of rupture, section modulus, Flexural rigidity, Bending stress distribution in rectangular, T, I and hollow rectangular sections (symmetrical about one-axis). Problems.

Shear stress in beams: Derivation of Shear stress equations, Derivation of Expressions of the shear stress for rectangular, triangular and circular cross sections of the beams. Problems on calculation of the shear stress at various critical levels of Rectangular, T, I and Hollow rectangular cross sections of the beam.

Self-study component:	Beams of Uniform strength in bending.	
Practical Topics: (4 Hours)	1.Single and Double Shear test on mild steel 2.Tests on Tiles	
UNIT – V		**8 Hours**

Torsion of prismatic circular shafts: Introduction- pure torsion, torsion equation of circular shafts, strength and stiffness equations, torsional rigidity and polar modulus for solid and hollow circular shafts, power transmitted by solid and hollow circular shaft and problems.

Elastic stability of columns: Introduction, short and long columns, failure of short and long columns, effective length, slenderness ratio, radius of gyration and buckling load or crippling load, assumptions and derivation of equations for Euler's buckling load for different end conditions (Both ends hinged, one end fixed and the other end free, Bothe ends fixed and One end fixed and the other is hinged), limitations of Euler's theory and Numerical problems. Rankine's theory and related problems.

Self-study component:	Torsion in composite shafts, Buckling loads by Perry-Robertson formula
Practical Topics: (4 Hours)	1.Impact test on mild steel (Charpy and Izod) 2.Tests on hollow and solid building blocks

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with *Action verbs* for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	*Examine* the basic concepts of the stresses and strains in materials under load and understand the relevant properties of engineering materials. **(PO1, PO2, PSO1)**	Analyzing	L4
CO2	*Evaluate* the internal forces and identify resistance mechanism for one dimensional and two dimensional structural elements subjected to various types of loads that are axial, flexural and torsional in nature. **(PO1, PO2, PSO1)**	Evaluating	L5
CO3	*Analyze* the deformations induced in structural elements subjected to various types of loads. **(PO1, PO2, PSO1, PSO2)**	Analyzing	L4
CO4	Understand the engineering properties of materials under tension, compression, impact, bending and shear by *experimentations*. **(PO1, PO2, PO4, PSO1, PSO3)**	Applying	L3
CO5	*Estimate* the hardness properties of ferrous and non- ferrous metals by suitable *experiments* and to understand the various tests to be conducted on building materials such as bricks, building blocks and tiles. **(PO1, PO2, PO4, PSO1, PSO3)**	Applying and Evaluating	L3 & L5

Text Book(s):

1. "Strength of Materials and Theory of Structures", Punmia B C, Jain R K, Volume 1 &Volume 2, Laxmi publications, New Delhi.
2. "Strength of Materials" in SI Units, B.S. Basavarajaiah, P. Mahadevappa, University Press (India) Pvt. Ltd., 3rd Edition,2010
3. "A Textbook of Strength of Materials", R K Bansal, 6th Edition, Laxmi Publications, 2018.

Reference Book(s):

1. "Elements of Strength of Materials" D.H. Young, S.P. Timoshenko, East West Press Pvt. Ltd., 5th Edition (Reprint2014).
2. "Mechanics of Materials", Ferdinand P. Beer, E. Russell Johnston and Jr. John T. De Wolf, Tata McGraw-Hill, Third Edition, SI Units
3. "Strength of Materials" S.S. Rattan, McGraw Hill Education (India) Pvt. Ltd., Third Edition (Sixth reprint2013).
4. "Analysis of Structures" Vazirani, V N, Ratwani M M. and S K Duggal, Volume I, 17th Edition, Khanna Publishers, New Delhi.

Web and Video link(s):

1. Strength of Materials by Prof. S.K. Bhattacharyya, IIT Kharagpur
   https://nptel.ac.in/courses/105105108/
2. Advanced Strength of Materials by Prof. S.K. Maiti, IIT Bombay
   https://archive.nptel.ac.in/course.html
3. Strength of Materials video course by IIT Roorkee https://nptel.ac.in/courses/112107147/

E-Books/Resources:

1. Strength of Materials by Prof. S.K. Bhattacharyya, IIT Kharagpur
   https://nptel.ac.in/courses/105105108/
2. Strength of Materials by Prof. M.S. Sivakumar, IIT Madras
   https://archive.nptel.ac.in/courses/112/106/112106141/
3. Strength of Materials by Dr. Satish C Sharma, IIT Roorkee
   https://nptel.ac.in/courses/112107146/

COURSE ARTICULATION MATRIX (STRENGTH OF MATERIALS – P22CV305)														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											2		
CO2	2	2											2		
CO3	2	2											2	1	
CO4	1	1		1									1		2
CO5	1	1		1									1		2

3 – HIGH, 2 – MEDIUM, 1 - LOW

COMPUTER AIDED BUILDING PLANNING AND DRAWING

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	P22CVL306	Credits:	01
Teaching Hours/Week (L:T:P):	0:0:2	CIE Marks:	50
Total Number of Teaching Hours:	26	SEE Marks:	50

Course Objectives: Provide students with a basic understanding
1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

UNIT - 1	04 Hours

Introduction to AUTO CAD software and its applications: Use of drawings, editing and annotation tools. Introduction to the use of layers, blocks and dimension text leader. Presentation and plotting with AUTO CAD.

UNIT - 2	06 Hours

Drawings Related to Different Building Elements:

Following drawings are to be prepared for the data given using CAD Software

a) Stepped wall footing.
b) Bonds in brick masonry- English & Flemish
c) Lintel and chajja (SUNSHADE).
d) Fully paneled and flush doors
e) Half paneled and half-glazed window

Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing.

UNIT - 3	10 Hours

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

➢ Drawing of Plan, elevation and sectional elevation for Single and double storey residential building.

Note:
• Students should sketch to dimension the above in a sketch book before doing the computer drawing.
• One compulsory field visit/exercise to be carried out.

Single line diagrams to be given in the examination.

UNIT - 4	06 Hours

Layout and Inter connectivity diagrams:

➢ Electrical LAYOUT, plumbing and sanitary LAYOUT for: Single and double storey residential building.

Functional design of building using inter connectivity diagrams (bubble diagram), development of line   diagram only for i) Primary health centre, ii) Primary school building, iii) College canteen iv) Office building.

Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing.
One compulsory field visit/exercise to be carried out.

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	Prepare, read and interpret the drawings and apply in a professional set up. **(PO1, PO5, PSO1, PSO3)**	Applying	L3
CO2	Know the procedures of submission of drawings and develop working and submission drawings for building. **(PO1, PO5, PSO1, PSO3)**	Applying	L3
CO3	Plan and design a residential or public building as per the given requirements. **(PO1,PO3,PSO2,PSO3)**	Create	L6

Question paper pattern:
- There will be one full question from unit-2 and unit-4 with each full question carrying fifteen marks. Students have to answer any one question.
- There will be one compulsory question from unit- 3 carrying thirty-five marks.

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

Reference Book(s):
1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.
2. IS: 962-1989 (Code of practice for architectural and building drawing).
3. National Building Code, BIS, New Delhi.
4. Building Planning And Drawing, 7th Edition, Dr. N Kumaraswamy and A.Kameshwara Rao

Web and Video link(s):
- https://m.youtube.com/watch?v=cmR9cfWJRUU
- https://m.youtube.com/watch?v=ONapRVyXn2E
- https://m.youtube.com/watch?v=hO865EIE0p0

E-Books/Resources:
https://bookauthority.org/books/best-cad-ebooks

COURSE ARTICULATION MATRIX
(COMPUTER AIDED BUILDING PLANNING AND DRAWING – P22CVL306)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2				2								2		2
CO2	2				2								2		2
CO3	2		2											2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW															

P.E.S. College of Engineering, Mandya
Department of Civil Engineering

EMPLOYABILITY ENHANCEMENT SKILLS - III
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – III

Course Code:	P22HSMC307	Credits:	01
Teaching Hours/Week (L:T:P)	0:2:0	CIE Marks:	50
Total Number of Teaching Hours:	30	SEE Marks:	50

Course Learning Objectives: This course will enable the students to:
- Calculations involving percentages, profit & loss and discounts.
- Explain concepts behind logical reasoning modules of direction sense and blood relations.
- Prepare students for Job recruitment process and competitive exams.
- Develop Problem Solving Skills.
- Apply programming constructs of C language to solve the real-world problem.

UNIT – I		06 Hours

Quantitative Aptitude: Number System – Divisibility & Remainder, Multiples & Factors, Integers, HCF & LCM, Decimal Fractions, Surds & Indices, Simplification.

Self-study component:	Linear equations.

UNIT – II		06 Hours

Quantitative Aptitude: Percentages, Profits, Loss and Discounts.

Logical Reasoning: Blood Relations.

Self-study component:	Inferred meaning, Chain rule.

UNIT – III		06 Hours

Logical Reasoning: Direction Sense Test.

Verbal Ability: Change of Speech and Voice, Sentence Correction.

Self-study component:	Height & distance.

UNIT – IV	C-PROGRAMMING - I	06 Hours

Introduction: Keywords and Identifier, Variables and Constants, Data Types, Input/Output, Operators, Simple Programs.

Flow Control: If…else, for Loop, while Loop, break and continue, switch…case, goto, Control Flow Examples, Simple Programs.

Functions: Functions, User-defined Functions, Function Types, Recursion, Storage Class, Programs
Arrays: Arrays, Multi-dimensional Arrays, Arrays & Functions, Programs.

Self-study component:	Evaluation of Expression.

UNIT – V	C-PROGRAMMING - II	06 Hours

Pointers: Pointers, Pointers & Arrays, Pointers and Functions, Memory Allocation, Array & Pointer Examples.

Strings: String Functions, String Examples, Programs.
Structure and Union: Structure, Struct & Pointers, Struct & Function, Unions, Programs.
Programming Files: Files Input/output

Self-study component:	Error handling during I/O operations.

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
	Course Outcomes: On completion of this course, students are able to:		
CO1	Exhibit amplified level of confidence to express themselves in English.	Applying	L3
CO2	Solve the problems based on Number systems, percentages, profit & loss and discounts.	Analyzing	L4
CO3	Solve logical reasoning problems based on direction sense and blood relations.	Analyzing	L4
CO4	Apply suitable programming constructs of C language and / or suitable data structures to solve the given problem.	Applying	L3

Text Book(s):

1. The C Programming Language (2nd edition) by Brian Kernighan and Dennis Ritchie.
2. C in Depth by S K Srivastava and Deepali Srivastava.
3. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):

1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Prentice Hall of India.
2. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

Web and Video link(s):

5. Problem Solving through Programming in C -
   https://archive.nptel.ac.in/courses/106/105/106105171/

COURSE ARTICULATION MATRIX (EMPLOYABILITY ENHANCEMENT SKILLS - III – P22HSMC307)												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		2
CO2	2	2										
CO3	2	2										
CO4	2	2								2		1

BIOLOGY FOR ENGINEERS			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – III			
Course Code:	**P22BFE308**	**Credits:**	**02**
Teaching Hours/Week (L:T:P)	**2:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**25**	**SEE Marks:**	**50**

Course Learning Objectives:

The objectives of this course are to,
➢ Familiarize the students with the basic biological concepts and their engineering applications.
➢ Enable the students with an understanding of bio-design principles to create novel devices and structures.
➢ Provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
➢ Motivate the students to develop the interdisciplinary vision of biological engineering.

Course Content

Biomolecules And Their Applications (Qualitative): Carbohydrates (cellulose-based water filters, PHA and PLA as bio-plastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (bio-diesel, cleaning agents/detergents), Enzymes (glucose-oxidase in bio-sensors, lingolytic enzyme in bio-bleaching). **5Hrs**

UNIT-II

Human Organ Systems And Bio-Designs-1 (Qualitative): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics, Engineering solutions for Parkinson's disease), Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). **5Hrs**

UNIT-III

HUMAN ORGAN SYSTEMS AND BIO-DESIGNS-2 (QUALITATIVE): Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine), Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). **5Hrs**

UNIT-IV

Nature Bio Inspired Materials And Mechanisms (Qualitative): Echolocation (ultra sonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts).
5Hrs

UNIT-V

Trends In Bio- Engineering (Qualitative): DNA origami and Bio-computing, Bio-imaging and Artificial Intelligence for disease diagnosis, Self healing Bio-concrete (based on bacillus spores, calcium lactate nutrients and bio-mineralization processes), Bio-remediation and Bio-mining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).
5Hrs

Suggested Learning Resources:
• Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook, 16thEdition, 2022.
• Biology for Engineers, Thyagarajan S, SelvamuruganN, Rajesh M. P, Nazeer R. A, Thilagaraj W, Barathi. S and Jaganthan M.K, Tata McGraw-Hill, New Delhi, 2012.
• Biology for Engineers, Arthur T.Johnson, CRC Press, Taylor and Francis, 2011.
• Bio-medical Instrumentation, Leslie Cromwell, Prentice Hall, 2011.
• Biology for Engineers, Sohini Singh and Tanu Allen,Vayu Education of India, New Delhi, 2014.
• Bio-mimetics: Nature Based Innovation,Yoseph Bar-Cohen,1st edition, 2012, CRC Press.
• Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
• Bio-remediation of heavy metals: bacterial participation, C R Sunil Kumar, N Geetha, A C Udayashankar, Lambert Academic Publishing, 2019.
• 3D Bio-printing: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
• Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016.

Web links and Video Lectures (e-Resources):
• VTUEDUSAT/SWAYAM/NPTEL/MOOCS/Coursera/MIT-open learning resource
• https://nptel.ac.in/courses/121106008
• https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
• https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
• https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
• https://www.coursera.org/courses?query=biology
• https://onlinecourses.nptel.ac.in/noc19_ge31/preview
• https://www.classcentral.com/subject/biology
• https://www.futurelearn.com/courses/biology-basic-concepts

Course Outcomes

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

1. **Understand** the bio-design principles involved in building novel devices and structures.
2. **Elucidate** the basic biological concepts through relevant industrial/Engineering application.
3. **Apply** innovative bio based solutions solving socially relevant problems.

Course Articulation Matrix													
Course Outcomes		**Program Outcomes**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**Understand** the bio-design principles involved in building novel devices and structures.	2	1				1	1	1				1
CO2	**Elucidate** the basic biological concepts through relevant industrial application.	2	1				1	1	1				1
CO3	**Apply** innovative bio based solutions solving socially relevant problems.	2	2				2	2	1				2

Blooms Level	**Marks Weightage**	**Maps Course Outcome to the Corresponding Blooms Level**
Understand/Elucidate	50-60%	
Apply	35-50%	

NATIONAL SERVICE SCHEME
[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER - III

Course Code:	P22NSS309/409	Credits:	00
Teaching Hours/Week (L:T:P):	0:0:2	CIE Marks:	100
Total Number of Teaching Hours:	-	SEE Marks:	-

Pre-requisites to take this Course:

1. Students should have a service oriented mind set and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service oriented targets on time.

Corse Objectives :National Service Scheme (NSS) will enable the students to:

1. Understand the community in which they work
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes
5. Develop capacity to meet emergencies and natural disasters & practice national integration and
   social harmony

Content

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/
   vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath,Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

   AND

ONENSS – CAMP @ College /University /Stateor Central GovtLevel /NGO's /General Social Camps

Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same. Compulsorily students have to attend one camp.

CIE will be evaluated based on their presentation, approach and implementation strategies.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the importance of his / her responsibilities towards society.
CO2:	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3:	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4:	Implement government or self-driven projects effectively in the field.

PHYSICAL EDUCATION
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER - III

Course Code:	P22PED309	Credits:	00
Teaching Hours/Week (L:T:P):	0:0:2	CIE Marks:	100
Total Number of Teaching Hours:		SEE Marks:	-

Fitness Components	Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. Practical Components: Speed, Strength, Endurance, Flexibility, and Agility	
Speed Strength Endurance Agility Flexibility	KABADDI A. Fundamental skills 　1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 　2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 　3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 　4. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials.	
Kho kho	A. Fundamental skills 　1. Skills in Chasing: Sit on the box (Parallel & Bullet toe method), Get up from the box (Proximal & Distal foot method), Give Kho (Simple, Early, Late & Judgment), Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul. 　2. Skills in running: Chain Play, Ring play and Chain & Ring mixed play. 　3. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials.	
Kabaddi	A. Fundamental skills 　1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 　2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 　3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 　4. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials	

YOGA			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER - III			
Course Code:	**P22YOG309**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:		**SEE Marks:**	**-**

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
1. Improved body flexibility and balance
2. Improved cardiovascular endurance (stronger heart)
3. Improved digestion
4. Improved abdominal strength
5. Enhanced overall muscular strength
6. Relaxation of muscular strains
7. Weight control
8. Increased energy levels
9. Enhanced immune system
- Mental
1. Relief of stress resulting from the control of emotions

2. Prevention and relief from stress-related disorders
3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
1. Life with meaning, purpose, and direction
2. Inner peace and tranquility
3. Contentment

Yoga, its origin, history and development. Yoga, its meaning, definitions.

Different schools of yoga, Aim and Objectives of yoga, importance of prayer

Yogic practices for common man to promote positive health

Rules to be followed during yogic practices by practitioner

Yoga its misconceptions,

Difference between yogic and non yogic practices

Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Padmasana

        2. Vajrasana

b. Standing 1. Vrikshana

        2. Trikonasana

c. Prone line 1. Bhujangasana

        2. Shalabhasana

d. Supine line 1. Utthitadvipadasana

        2. Ardhahalasana

Additional Mathematics - I			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – III (Lateral Entry: Common to all branches)			
Course Code:	P22MDIP301	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	2-2-0	**CIE Marks:**	**100**
Total Number of Teaching Hours:	40	**SEE Marks:**	**-**

Course Learning Objectives: The mandatory learning course P21MATDIP31 viz., Additional Mathematics-I aims to provide basic concepts of complex trigonometry, vector algebra, differential & integral calculus, vector differentiation and various methods of solving first order differential equations.

UNIT-I	
Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof). Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems **Self-study components:** De-Moivre's theorem (without proof). Roots of complex number - Simple problems.	**12 Hrs**

UNIT-II	
Differential Calculus: Polar curves –angle between the radius vector and the tangent pedal equation- Problems. Taylors series and Maclaurin's series expansions- Illustrative examples. Partial Differentiation: Elimentary problems. Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. **Self-study components**: Review of successive differentiation. Formulae for n^{th} derivatives of standard functions- Liebnitz's theorem (without proof). Application to Jacobians, errors & approximations.	**10 Hrs**

UNIT-III	
Integral Calculus: reduction formulae for $sin^n x,\ cos^n x,\ and\ sin^m x cos^m x$ and evaluation of these with standard limits-Examples. Applications of integration to area, length of a given curve, volume and surface area of solids of revolution. **Self-study components**: Differentiation under integral sign (Integrals with constants limits)- Simple problems.	**10 Hrs**

UNIT-IV	
Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). **Self-study components**: Solenoidal and irrotational vector fields-Problems.	**10 Hrs**

UNIT-V	
Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types. **Self-study components**: Applications of first order and first degree ODE's - Orthogonal trajectories of Cartesian and polar curves. Newton's law of cooling, R-L circuits- Simple illustrative examples from engineering field.	10 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1:	Demonstrate the fundamental concepts –in complex numbers and vector algebra to analyze the problems arising in related area of engineering field.
CO2:	Identify – partial derivatives to calculate rate of change of multivariate functions
CO3:	Apply - the acquired knowledge of integration and differentiation to evaluate double and triple integrals to compute length surface area and volume of solids of revolution and indentify velocity, acceleration of a particle moving in a space
CO4:	Find analytical solutions by solving first order ODE's which arising in different branches of engineering.

Text Book:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.

Reference books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.

2. N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers,7th Ed., 2007.

P.E.S. College of Engineering, Mandya

Department of Civil Engineering

Additional Communicative English – I			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – III			
Course Code:	P22HDIP307	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	0:2:0	**CIE Marks:**	**100**
Total Number of Teaching Hours:	40	**SEE Marks:**	**-**

Module-1	
Introduction to Communication Skills	**6 Hours**
Introduction to communication, Meaning and process, Channels of communication, Elements of communication, Barriers to effective communication. Activities - Making introductions, Sharing personal information, Describing feelings and opinions.	

Module-2	
Listening Skills I	**4 Hours**
Hearing vs. Listening, Types of listening, Determinants of good listening, Active listening process, Barriers to listening, Activities - Listening for pronunciation practice, Listening for personal communication, Listening for communication - language functions	

Module-3	
Speaking Skills I	**6 Hours**
Basics of speaking, Elements and Functions of speaking, Structuring your speech, Focusing on fluency, Homographs and Signpost words. Activities – Free Speech and Pick and Speak	

Module-4	
Reading Skills I	**4 Hours**
Developing reading as a habit, Building confidence in reading, improving reading skills, Techniques of reading - skimming and scanning. Activities - understanding students' attitudes towards reading, countering common errors in reading, developing efficiency in reading.	

Writing Skills I	**4 Hours**
Improving writing skills, Spellings and punctuation, Letter and Paragraph writing. Activity – Writing your personal story	

Module-5	
Body Language and Presentation Skills	**6 Hours**
Elements of body language, Types, Adapting positive body language, Cultural differences in body language. 4 Ps in presentations, Overcoming the fear of public speaking, Effective use of verbal and nonverbal presentation techniques. Activity – Group presentations	

Course Outcomes: On completion of this course, students will be able to,

CO 1: Understand the role of communication in personal and professional success

CO 2: Comprehend the types of technical literature to develop the competency of students to apprehend
the nature of formal communication requirements.

CO 3: Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence

CO 4: Demonstrate effective individual and teamwork to accomplish communication goals.

Textbooks and Reference Books:

1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press - 2015.

2. Everyday Dialogues in English by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.

3. Developing Communication Skills by Krishna Mohan& Meera Banerjee (Macmillan)

4. The Oxford Guide to Writing and Speaking, John Seely, Oxford.

5. English Language Communication Skills - Lab Manual cum Workbook by Rajesh Kumar Singh, Cengage learning India Pvt Limited – 2018

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1												2			
CO2									2						
CO3									2						
CO4									2						
CO									2	2		2			

APPLIED MATHEMATICAL METHODS

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV (COMMON TO CV, ME, IP, AU)

Course Code:	P22MA401A	Credits:	03
Teaching Hours/Week (L:T:P):	2-2-0	CIE Marks:	50
Total Number of Teaching Hours:	40	SEE Marks:	50

	Course Learning Objectives:		
1	**Familiarize** the importance of calculus of complex functions associated in dual plane, best fit curves and regression lines, random variables and probability distributions, solutions of ordinary differential equations by using power series.		
2	**Apply** C-R equations to find analytic, potential, stream functions, evaluate complex integrals, properties of regression lines, probability functions to analyse distributions, solve differential equations by power series method.		

Unit	Syllabus content	No. of hours	
		Theory	Tutorial
I	**Calculus of complex functions**: Introduction to complex variables. Definitions- limit, continuity, differentiability and Analytic functions of f(z) : Cauchy- Riemann equations in Cartesian and polar forms (no proof)-Harmonic function and Problems. Applications to flow problems. Construction of analytic functions when $u\ or\ v\ or\ u \pm v$ are given- Milne-Thomson method. Conformal transformations: Introduction. Discussion of transformations for $W = z^2$, $W = e^z$, $W = z + \frac{1}{z}\ z \neq 0$ **Self-Study:** Derivation of Cauchy- Riemann equation in Cartesian and polar form	06	02
II	**Complex integration:** Bilinear Transformations- Problems, line integrals of complex function. Cauchy's theorem, Cauchy's integral formula. Taylor's and Laurent's series (Statements only)- illustrative examples. Singularities, poles and residues with examples, Cauchy's Residues Theorem (statement only)- Illustrative examples. **Self-Study:**– Contour integration Type-I & Type-II problems	06	02
III	**Statistical Methods:** **Statistics:** Brief review of measures of central tendency and dispersion. Moments, skewness and kurtosis. **Curve Fitting:** Curve fitting by the method of least squares, fitting the curves of the forms $y = ax +$, $y = ab^x$ $and\ y = ax^2 + bx + $ c. **Correlation and regression**: Karl Pearson's coefficient of correlation and rank correlation- problems, Regression analysis, lines of regression and problems. **Self-Study**: Fit a curve of the form $y = a + bx$, $y = a +bx+cx^2$	06	02
IV	**Probability and Distribution:** **Random variables and Probability Distributions:** Review of random variables. Discrete and continuous random variables- problems. Binomial, Poisson, Exponential and Normal	06	02

	distributions (with usual notation of mean and variance)-: problems. **Joint Probability Distributions :** Introduction, Joint probability and Joint distribution of discrete random variables and continuous random variables **Self-study:** Geometric and Gamma distributions- problems.		
V	**Special functions:** Power series solution of a second order ODE, Series solution-Frobenius method. Series solution of Bessel's differential equation leading to $J_n(x)$. Expansions for $J_{1/2}(x)$ and $J_{-1/2}(x)$. Series solutions of Legendre's differential equation leading to $P_n(x)$-Legendre's polynomials - simple illustrative examples **Self study:** Basics of Series solutions of ODE's; analytic, singular point and basic recurrence relations.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:	
CO1	**Understand** fundamental concepts in calculus of complex functions, statistics, probability and special functions.
CO2	Apply tools taught to analyze transformations arising in engineering field and evaluate complex integrals and draw statistical inferences
CO3	**Analyze** problems in engineering field by employing special functions, complex functions and statistical methods.
CO4	**Evaluate** integrals of complex functions, regression and correlation coefficient, probability of a discrete and continuous variable, series solution of special differential equations.

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXT BOOKS
1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS
1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education,11th Ed..
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International Publishing House Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/
4. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/
5. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/differential-equations/first-order-differential-equations/

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	3										
CO3	3	2										
CO4	2	3										
Strength of correlation: Low-1, Medium- 2, High-3												

**ANALYSIS OF STRUCTURES**				

<table>
<tr><td colspan="5" align="center">ANALYSIS OF STRUCTURES
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – IV</td></tr>
<tr><td>Course Code:</td><td>P22CV402</td><td>Credits:</td><td colspan="2">03</td></tr>
<tr><td>Teaching Hours/Week (L:T:P):</td><td>3:0:0</td><td>CIE Marks:</td><td colspan="2">50</td></tr>
<tr><td>Total Number of Teaching Hours:</td><td>40</td><td>SEE Marks:</td><td colspan="2">50</td></tr>
</table>

Course Learning Objectives: This course will enable the students:

1. To determine slopes and deflections of beams using various methods.

2. To analyze pin jointed trusses, arches and cables under the action of loads and to carryout analysis of beams subjected to moving loads using Influence line diagrams.

3. To understand the basic concepts of analysis of indeterminate structure and to analyze continuous beams, sway and non-sway frames using slope deflection method, moment distribution method, Kani's method and Matrix methods.

UNIT – I	08 Hours

Deflection of Beams: Moment area method- Moment Area Theorems-Statements and derivation, sign convention; Application of moment area method to determinate slope and deflection in prismatic beams and beams of varying cross section.

Conjugate beam method – Introduction, support conditions for the conjugate beams, Application of conjugate beam method to determine slope and deflection in prismatic beams and beams of varying cross section.

Self-study component:	Numerical problems on beams with couples

UNIT – II	08 Hours

Analysis of Plane trusses: Introduction, assumptions, different types of trusses, methods of analysis of simple plane trusses, Numerical problems using Method of joints.

Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complementary energy, Strain energy due to axial force, bending, shear and torsion. Deflection of determinate beams and trusses using total strain energy, Castigliano's theorems, application of Castigliano's theorems to calculate deflection of trusses.

Self-study component:	Introduction to method of section, Unit load method for determining deflections.

UNIT – III	08 Hours

Influence line diagram and rolling loads: Introduction to influence line diagram, uses, construction of ILD for support reactions, shear force and bending moments in simply supported beam subjected to series of point loads and UDL shorter than span.

Analysis of Arches: Three-hinged circular and parabolic arches with supports at the same and different levels; Determination of normal thrust, radial shear and bending moment.

Analysis of Cables: Analysis of cables under point loads and UDL, Length of cables with supports at the same and different levels. Cable passing over pulley and saddle.

Self-study component:	Stiffening trusses for suspension cables.

UNIT – IV	**08 Hours**

Introduction to analysis of indeterminate structures: Stability and determinacy of structures, Degree of static and kinematic indeterminacy in structures. Numerical problems.

Slope Deflection Method: Introduction, sign convention, Development of Slope-deflection equations and Analysis of Beams and Orthogonal Rigid jointed plane frames (non-sway and sway) with kinematic redundancy less than or equal to three. (Members to be axially rigid)

Moment Distribution Method: Introduction, Distribution factor, Analysis of continuous beams and orthogonal rigid jointed plane frames (non-sway only) with kinematic redundancy less than/equal to three (Members to be axially rigid).

Self-study component:	Analysis of sway frames by moment distribution method, analysis of 2-hinged arches.

UNIT – V	**08 Hours**

Kani's Method: Introduction, Basic Concept, Analysis of Continuous beams and orthogonal rigid jointed plane frames (non-sway only). Analysis of rigid jointed plane frame with symmetry considerations (non-sway only).

Introduction to Matrix method of analysis:
Introduction, Axes and coordinates, Flexibility matrix and Stiffness matrix, Analysis of continuous beams using Flexibility Matrix Method and Stiffness Matrix Method by system approach with indeterminacy ≤ 3.

Self-study component:	Analysis of sway frames by Kani's method, introduction to analysis of indeterminate beams by consistent deformation method.

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	*Evaluate* slope and deflections of beams using various approaches. **(PO1, PO2, PSO1, PSO2, PSO3)**	Evaluating	L5
CO2	*Analyze* pin jointed trusses, arches and cables under the action of loads and to extend the analysis to beams under moving loads using ILD. **(PO1, PO2, PSO1, PSO2, PSO3)**	Analyzing	L4
CO3	Understand the basic concepts of *analysis* of indeterminate structure and to analyze continuous beams, sway and non-sway frames using various approaches. **(PO1, PO2, PSO1, PSO2, PSO3)**	Analyzing	L4

Text Books:

1. "Theory of structures" S.P. Gupta, G.S. Pandit and R. Gupta, Volume 1, Tata Mc-Graw Hill, New Delhi.

2. "Basic Structural Analysis", Reddy C.S. – Second Edition, Tata McGraw Hill Publication

Company Ltd.

3. "Structural Analysis", L S Negi and R S Jangid, Tata McGraw-Hill Publishing Company Ltd.

Reference Book(s):

1. "Structural Analysis" D.S. PrakashRao., A Unified Approach, University Press.
2. "Theory of Structures", S.P. Gupta, G.S. Pandit and R. Gupta, Volume 2, Tata McGraw Hill Publication Company Ltd.
3. "Indeterminate Structural Analysis" J. Sterling Kinney, Oxford and IBH Publishing Co.
4. "Intermediate Structural Analysis" C.K. Wang., McGraw Hill Publications.
5. "Structural Analysis-II", S.S. Bhavikatti – Vikas Publishers, New Delhi.

Web and Video link(s):

1. Structural Analysis I, Prof. Amit Shaw, IIT Kharagpur https://nptel.ac.in/courses/105105166 https://nptel.ac.in/courses/105105109
2. Matrix method of Structural analysis, Prof. Biswanath Banjerjee, Prof. Amit Shaw, IIT Kharagpur https://archive.nptel.ac.in/courses/105/105/105105180/

E-Books/Resources:

1. Structural Analysis I, Prof. Amit Shaw, IIT Kharagpur https://archive.nptel.ac.in/courses/105/105/105105166/
2. 2.Structural Analysis II, Prof. L S Ramachandra, Prof. Sudhir Kumar Bri, IIT Kharagpur https://nptel.ac.in/courses/105105109
3. 3.Matrix method of Structural analysis, Prof. Biswanath Banjerjee, Prof. Amit Shaw, IIT Kharagpur (https://archive.nptel.ac.in/courses/105/105/105105180/)
4. 4.Structural analysis I, Dr. Siddhartha Ghosh, Dr. R.S. Jangid, IIT Bombay (https://archive.nptel.ac.in/courses/105/101/105101085/)

COURSE ARTICULATION MATRIX (ANALYSIS OF STRUCTURES – P22CV402)															
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											2	2	1
CO2	2	2											2	2	1
CO3	2	2											2	2	1
3 – HIGH, 2 – MEDIUM, 1 - LOW															

HYDROLOGY AND IRRIGATION ENGINEERING			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – IV			
Course Code:	**P22CV403**	**Credits:**	**03**
Teaching Hours/Week (L:T:P)	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Understand the concepts of Hydrological process such as precipitation, evaporation, evapotranspiration and infiltration.
- Estimation of runoff and use of unit hydrograph.
- Explain the systems of Irrigation and compute crop water requirements.
- Design the stable canals and types of canals involved in conveyance of water.

UNIT – I	**Hydrology and Precipitation**	**08 Hours**

Hydrology: Introduction, Global water distribution and India's water availability. Hydrologic Cycle – General and Qualitative (Horton's) representation, Climatic seasons of India.

Precipitation: Forms and types. Measurement of Rainfall, Raingauge density, Optimum number of Raingauges, computation of mean rainfall, estimation of missing rainfall data, Numerical problems. Consistency of rainfall data – double mass curve method. Presentation of Rainfall data, mass curve and rainfall hyetographs.

Self-study component:	Formation of Precipitation, Radar measurement of rainfall.

UNIT – II	**Evaporation, Evapotranspiration and Infiltration**	**08 Hours**

Evaporation: Definition, Factors affecting evaporation, measurement of evaporation using ISI standard pan, estimation using Mayer's and Rowher's formula. Engineering applications and problems.

Evapotranspiration: Definition, AET and PET, factors affecting evapotranspiration, estimation of evapotranspiration using Blaney-Criddle equation. Engineering applications and problems.

Infiltration: Definition, Infiltration capacity, Measurement of infiltration using Double ring infiltrometer, Infiltration indices – Φ-Index and W-index. Engineering applications and problems.

Self-study component:	Reservoir evaporation and its control.

UNIT – III	**Runoff and Hydrographs**	**08 Hours**

Runoff: Definition, Concept of catchment, factors affecting runoff, Stream patterns, Classification of watersheds and streams. Estimation of runoff using Khosla's method.

Hydrographs: Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, conversion of UH of different durations. Engineering applications and problems.

Self-study component:	Rainfall-runoff relationship using regression analysis.

UNIT – IV	**Irrigation and Water Requirement of crops**	**08 Hours**

Irrigation: Definition, necessity of Irrigation, Advantages and Disadvantages of irrigation, System of Irrigation: surface and groundwater, flow irrigation, lift irrigation, drip irrigation and sprinkler irrigation.

Water requirement of crops: Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, Soil-moisture-irrigation relationship, frequency of irrigation. Engineering applications and problems.

Self-study component:	Methods to improve duty of water, Irrigation efficiency.

UNIT – V	Canals and its Design	08 Hours

Canals: Definition, Classification of canals, Alignment of canals, Cross section of Irrigation canals, Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor.

Design: Design of stable channels in India, Regime channel, Kennedy's theory, Lacey's theory. Design problems. Comparison of Kennedy's and Lacey's theory.

Self-study component:	Losses of water in canals, Maintenance of canals.

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	*Apply* the concepts of water resources in **understanding** Hydrology and Irrigation engineering. **(PO1, PSO1)**	Applying	L3
CO2	*Analyze* and *identify* the various dynamic aspects of Hydrological cycle and their relationships in solving complex problems of engineering field. **(PO2, PSO2)**	Analyzing	L4
CO3	*Analyze* and *identify* the various types of Irrigation systems, crop water requirements and its conveyance to the agricultural fields. **(PO2, PSO2)**	Analyzing	L4
CO4	*Design* the stable channels in India by Kennedy's and Lacey's theory. **(PO3, PSO2)**	Creating	L6

Text Book(s):

1. K Subramanya – Engineering Hydrology. McGraw Hill Education, 4th Edition, New Delhi.
2. P Jaya Rami Reddy – A Textbook of Hydrology, Lakshmi Publications, 3rd Edition, New Delhi.
3. Santosh Kumar Garg – Irrigation Engineering and Hydraulic Structures, Khanna Publications, Vol. 2, New Delhi.
4. Dr. P N Modi – Irrigation Water Resources and Water Power Engineering, Standard Book House, 11th Edition, New Delhi.

Reference Book(s):

1. Ven Chow, David Maidment and Larry Mays – Applied Hydrology, McGraw Hill Education, 1st Edition, India.
2. B C Punmia, Ashok Kumar Jain, Arun Kumar Jain and Pande Brij Basi Lal – Irrigation and Water Power Engineering, Laxmi Publications, 17th Edition, New Delhi, India.
3. R K Sharma – Irrigation Engineering (including Hydrology), S Chand Publication, Revised Edition 2007, India.

Web and Video link(s):

1. Hydrologic cycle and concept of catchment: https://youtu.be/iWb-V7dV7XM

2. Evaporation: https://youtu.be/4RZF1L70mRY
3. Estimation of Infiltration: https://youtu.be/caklKXXrHW4
4. Numerical examples on UH & DRH: https://youtu.be/FHY1BRmcFXU
5. Crop water requirement: https://youtu.be/e7pckUDQ9oI

E-Books/Resources:
1. https://searchworks.stanford.edu/view/6332733
2. https://searchworks.stanford.edu/view/550141
3. https://searchworks.stanford.edu/view/13795811

COURSE ARTICULATION MATRIX
(HYDROLOGY AND IRRIGATION ENGINEERING – P22CV403)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2		2												2	
CO3		2												2	
CO4			2											2	
3 – HIGH, 2 – MEDIUM, 1 - LOW															

GEODETIC ENGINEERING			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – IV			
Course Code:	P22CV404	**Credits:**	04
Teaching Hours/Week (L:T:P):	3–0–2	**CIE Marks:**	50
Total Theory Teaching Hours:	40	**SEE Marks:**	50
Total Laboratory Hours:	24		

Course Learning Objectives: This course will enable the students to:

- Provide basic knowledge about principles of surveying for location, design and construction of engineering projects.
- Develop skills for using surveying instruments including, levelling instruments, plane tables, theodolite, compass
- Make students to familiar with cooperative efforts required in acquiring surveying data and applying fundamental concepts to eliminate errors and set out the works.
- Provide information about new technologies that are used to abstracting the information of earth surface.

UNIT – I	Introduction	8 Hours

Introduction: Definition of surveying, classification of surveys, basic principles of surveying, Reconnaissance survey – Field Book.

Compass Surveying: Meridians and bearings, principle, working and use of prismatic compass, Surveyor's compass, magnetic bearing, true bearings, whole circle bearing and reduced bearing, Calculation of bearings and interior angles, local attraction-numerical problems.

Plane Table Surveying: Plane table and accessories, advantages and disadvantages of plane table survey, method of plotting - radiation, intersection, traversing.

Self-study component:	Dip and Declination with Numericals.

Practical Topics: (6 Hours)	1. Introduction to surveying instruments (major and minor) ii) preparation of a chart of conventional symbols and tape. 2. To set regular geometric figures (Hexagon and Pentagon) using chain, tape and compass. 3. Plane table : Setting, orientation, radiation, intersection

UNIT – II	Levelling, Area & Volume, Contouring	8 Hours

Introduction to Levelling: Principles and basic definitions – Types of Levels – Types of adjustments, Simple, Differential, Fly, Reciprocal, Profile, Cross sectioning – Book of levels – Rise & fall and H. I methods (Numericals)

Area and Volume Measurement: Measurement of area- by dividing the area into geometrical figures, area from offsets, mid ordinates, mid ordinate rule, trapezoidal and Simpsons one third rule, area from co-ordinates.

Contouring: Contours and their characteristics, methods of contouring, direct and indirect methods.

Self-study component:	Interpolation techniques and uses of contours.

Practical Topics: (6 Hours)	1. Determination of elevation of various points by plane of collimation method and rise & fall method and L-Section and cross section of the road. 2. Conduct block leveling and draw Counter plan of given area (with necessary drawing)

UNIT – III	Theodolite Surveying	8 Hours

Theodolite Survey : Theodolite and types, fundamental axes and relationship, parts of a transit theodolite, uses of theodolite, temporary adjustments of a transit theodolite, measurement of horizontal angles, method of repetitions and reiterations.

Trigonometric Levelling: Determination of elevation of objects when the base is accessible and inaccessible by single plane and double plane method, distance and difference in elevation between two inaccessible objects by double plane method. Numerical problems.

Self-study component:	Measurements of vertical angles by theodolite.

Practical Topics: (4 Hours)	1. Measurement of horizontal angle using theodolite: i) Repetition and ii) Reiteration. 2. Trigonometrical levelling: Single plane method and Double plane method

UNIT – IV	Curve Surveying	8 Hours

Simple curves: Curves - Necessity, types, simple curves, elements, designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), setting out curves by Rankine's deflection angle method (numerical problems).

Compound curve: Compound curves, elements of Compound curves,design of compound curves, setting out of compound curves.(No derivations)

Curve Setting -Reverse, Transition curves: Reverse curve between two parallel and non-parallel straights (Equal radius and unequal radius), Numerical problems.(No derivations)

Transition curves: Characteristics, length of transition curve (Numerical problems),

Self-study component:	Types of vertical curves (Theory)
Practical Topics: (4 Hours)	1. To set out simple curves using Rankine's deflection angles method. 2. Setting compound curve using theodolite

UNIT – V	Modern Surveying	8 Hours

Total Station: Introduction, basic concepts, measurement of distance using phase difference, components of total station, adjustments, Errors, accuracy, effect of atmospheric conditions. Advantages, limitations anduses of total station.

Remote sensing: Introduction, components and working principle and area of application. Advantages and disadvantages, types of remote sensing, Different types of platforms, Types of remote sensors.

Global Positioning Systems: Global positioning systems, segments of GPS, working principle, Hand held GPS and differential GPS, methods of GPS surveying, Errors and accuracy, Advantages and disadvantages and applications of GPS.

Self-study component:	Introduction to GIS, components and flow diagram of GIS, applications of GIS. Drone Survey

Practical Topics: (4 Hours)	1. Introduction to total station, components, temporary adjustments. 2. Measure Horizontal and vertical distance using Total Station.

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator

CO1	*Classify* surveying with measurement of angles by compass and area by plane table. **(PO1, PSO1)**	Analyzing	L4
CO2	*Assess* the data of levelling, contour plans and theodolite surveying to *interpret* the elevation and distances. **(PO1, PO2, PSO1)**	Evaluating	L5
CO3	*Choose* different curves for roads and railways and *explain* the principles and techniques of modern surveying equipments and their applications. **(PO3, PO5, PSO2)**	Applying	L3
CO4	*Make use of* linear and angular measurements for traverse by compass and plane table survey and *Solve* for levels and draft necessary drawings. **(PO1, PO4, PSO2)**	Applying	L3
CO5	*Apply* the techniques and skill of surveying to compute distance and elevation using trigonometric survey and *Construct* curves by various methods. **(PO1, PO4, PSO2)**	Applying	L3

Text Book(s):

1. Surveying, Vol-1 and Vol-2 - B.C. Punmia ,Laxmi Publications, New Delhi.
2. Plane Surveying, Vol-1 and Vol-2-A.M. Chandra, Newage International ® Ltd.
3. Advanced Surveying: Total Station, GPS, GIS & Remote Sensing by Pearson 2017 by Gopi Satheesh, R.Sathikumar, N. Madhu
4. Textbook of Remote Sensing and Geographical Information System 4th edition BS Publications by M. Anji Reddy

Reference Book(s):

1. Surveying Vol.I& II, S. K. Duggal, McGraw Hill Education; Fourth edition (2017)
2. Surveying and Levelling, R. Subramanian , second edition, 2012, Oxford University Press;
3. Fundamentals of Surveying - Milton O. Schimidt - Wong, Thomson Learning
4. Surveying and Levelling 2nd edition by R K Bansal.

Web and Video link(s):

https://www.youtube.com/channel/UCD9xFiECDPnQiVdjj-UvsRg/playlists

E-Books/Resources:

- https://searchworks.stanford.edu/view/2652850

COURSE ARTICULATION MATRIX															
(GEODETIC ENGINEERING – P22CV404)															
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2												1		
CO 2	1	1											1		
CO 3			2		2									2	
CO 4	2			2										1	
CO 5	2			2										2	
3 – HIGH, 2 – MEDIUM, 1 - LOW															

PUBLIC HEALTH ENGINEERING
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – IV

Course Code:	P22CV405	Credits:	04
Teaching Hours/Week (L:T:P):	3:0:2	CIE Marks:	50
Total Theory Teaching Hours:	40	SEE Marks:	50
Total Laboratory Hours:	24		

Course Learning Objectives: This course will enable the students to:

1. Analyze the variation of water demand and to estimate water requirements for a community.
2. Study of distribution systems of water supply and illustration of its layout.
3. Analysis of physical, chemical & biological characteristics of wastewater
4. Understand and design of different unit operations involved in water and waste water treatment processes.
5. Study drinking water quality standards and to illustrate qualitative analysis of water.

UNIT – I	**Water supply - Introduction & Water treatment**	**8 Hours**

Introduction: Water: Need for protected water supply, Demand of Water: Types -domestic demand, industrial, institutional, and commercial demand, public use and fire demand estimation. Per capita demand - factors affecting per capita demand, Variations in demand of water. Methods of population forecasting and numerical problems. Drinking water standards- BIS & WHO guidelines.
Water Treatment: Objectives, Unit flow diagrams – significance of each unit, Aeration process-Limitations and types

Self-study component:	Design period – factors governing the design period

Practical Topics: (6 Hours)	1. Determination of Solids in Sewage: Total Solids, Suspended Solids, Dissolved Solids, Volatile Solids, Fixed Solids, Settleable Solids 2. Determination of Alkalinity, Acidity and pH. 3. Determination of Calcium, Magnesium and Total Hardness.

UNIT – II	**Sedimentation & Filtration**	**8 Hours**

Sedimentation - Theory, settling tanks - types and design with numerical problems, Coagulation and flocculation, types of coagulants.
Filtration: Theory of filtration, types of filters - slow sand & rapid sand filters, also its operation, cleaning & design without under drainage system (numerical problems)

Self-study component:	Combined coagulation cum sedimentation tanks. Filter - pressure filters.

Practical Topics: (6 Hours)	1. Jar Test for Optimum Dosage of Alum 2. Turbidity determination by Nephelometer 3. Determination of Nitrates, Fluorides & Iron by spectrophotometer.

UNIT – III	Disinfection & Distribution systems	8 Hours

Disinfection: Methods of disinfection with merits and demerits. Breakpoint chlorination. Water Softening: Lime soda & Zeolite process

Distribution systems: requirement of a good distribution system, layout of distribution systems, methods of distribution systems, Distribution reservoirs – functions, types

Self-study component:	Fluoridation and de-fluoridation. Systems of supply

Practical Topics: (4 Hours)	1. Determination of percentage of available chlorine in bleaching powder 2. Determination of Residual Chlorine and Chlorine Demand.

UNIT – IV	Wastewater – Introduction & Preliminary Treatment	8 Hours

Introduction: Need for sanitation, types of sewerage systems and their suitability

Treatment of municipal waste water: Waste water characteristics- physical, chemical, and biological. Sampling-significance and techniques. Significance of BOD & COD, Numerical problems on BOD

Treatment Process: flow diagram for municipal waste water Treatment unit operations and process Preliminary Treatment: Screens: types, disposal. Grit chamber, oil and grease removal

Self-study component:	Self-cleansing and non- scouring velocity

Practical Topics: (4 Hours)	1. Determination of Dissolved Oxygen. 2. Determination of BOD.

UNIT – V	Wastewater treatment processes	8 Hours

Treatment process: Primary & secondary settling tanks (no numerical). Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter (numerical), Principle of septic tank, stabilization ponds, oxidation ditch, Sludge digesters (aerobic and anaerobic),

Self-study component:	Self-purification phenomenon, oxygen sag curve.

Practical Topics: (4 Hours)	1. Determination of chlorides 2. Determination of COD

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	*Apply* knowledge of mathematics to forecast population, to **determine** total quantity of water required to meet demands of community and *understand* various treatment processes of domestic water and municipal water. (**PO1, PSO1**)	Applying	L3
CO2	*Analyze* the drinking water quality parameters & sewage characteristics of a community from public health consideration as per standards and *illustrate* ideal distribution system for the community. (**PO2, PSO2**)	Analyzing	L4

CO3	*Design* the various units of water treatment plant & municipal water treatment plant. **(PO3, PSO2)**	Creating	L6
CO4	*Validate* the experiment data by comparing the obtained results with the concerned guidelines and **assess** health safety of the society **(PO4, PO6, PSO3)**	Evaluating	L5
CO5	*Manage* efficiently as an individual or lead a team and *develop* lifelong learning. **(PO9, PO12, PSO3)**	Creating	L6

Text Book(s):

1. S.K.Garg, Environmental Engineering vol-I, Water supply Engineering –,Khanna Publishers, New Delhi 2010.
2. B.C. Punmia& Ashok Jain,Environmental Engineering vol-I-Water supply Engineering, Lakshmi Publications (P) Ltd, New Delhi 2010.
3. S.K.Garg, Environmental Engineering vol-II, Water supply Engineering –,Khanna Publishers, New Delhi 2017
4. B.C. Punmia& Ashok Jain, Environmental Engineering vol-II- Water supply Engineering, Lakshmi Publications (P) Ltd, New Delhi 2016.

Reference Book(s):

1. Howard S. Peavey, Donald R. Rowe, George T, "Environmental Engineering" – Tata McGraw Hill, New York, Indian Edition, 2013 Publishers, New Delhi, 2009.
2. CPHEEO Manual on Water supply and treatment Engineering, Ministry of Urban Development, Government of India, New Delhi.

Web and Video link(s):

- https://youtu.be/yDnrv-oGSBc
- https://youtu.be/K4Vty0cmybI
- https://youtu.be/bCKm9KkcQtw
- https://youtu.be/mVmErXpIp64
- https://youtu.be/qXUwy5OnX9Q
- https://youtu.be/QyLdA_qhUog
- https://youtu.be/rKTwjvx7E8A
- https://youtu.be/PEX_0DebrSQ

COURSE ARTICULATION MATRIX (PUBLIC HEALTH ENGINEERING– P22CV405)														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2		
CO2		2												2	
CO3			2											2	

CO4			2	2										2
CO5					2				2					2

<div align="center">3 – HIGH, 2 – MEDIUM, 1 - LOW</div>

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CONCRETE AND NON-DESTRUCTIVE TESTING LABORATORY

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV

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Course Code:	**P22CVL406**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**26**	**SEE Marks:**	**50**

Course Objectives:
1. Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy
2. Characterize the physical properties of cement and correlate with the specifications of relevant IS codes.
3. Ascertain and measure the engineering properties of fresh concrete and hardened concrete.
4. Ascertain and measure the engineering properties of Self compacted concrete
5. Able to determine the strength of structural elements by non-destructive testing methods.

SL.NO	EXPERIMENTS
1	Testing of cement: Specific gravity of cement, Normal Consistency, Setting time, Soundness test, fineness, Compression strength test.
2	Tests on aggregates – fine and coarse – Specific Gravity, Sieve Analysis, Moisture Content, as per Codal Requirements.
3	Concrete mix design by IS code method as per 10262-2019 & 456-2000.
4	Tests on fresh concrete: Workability tests–Slump cone test, Compaction factor test, Vee-bee Consistometer test.
5	Tests on hardened concrete: Compression strength, Split tensile Strength, flexural strength.
6	Tests on special Concrete: SELF COMPACTING CONCRETE. (S.C.C.) Fresh concrete: Slump test, Flow tests (V Funnel Test, L Box Test, U Box Test, Flow table test – T50, J-Ring test) as per EFNARC.
7	Non-destructive tests: Schmidt Rebound hammer test, Ultra sonic Pulse velocity test, Corrosion Analysis test, Cover Meter and Rebar Detectors test, core cutter test

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator

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CO1	Recall the fundamental definitions and examine and evaluate properties of cement (**PO1, PSO1**)	Applying	L3
CO2	Determine the properties of fresh concrete and hardened concrete for conventional concrete and fresh properties of self-compacting concrete (**PO1, PO2, PSO1**)	Applying	L3
CO3	Design the concrete mix for the given materials as per codal provisions (**PO1, PO3, PSO1**)	Creating	L6
CO4	Determine the Strength of structural elements and their behaviour by using NDT equipment. (**PO1, PO2, PO5, PSO2**)	Analyzing	L4

Text Book(s):

1. Concrete Technology, Theory and Practice : M. S. Shetty & A K Jain , 8th Edition, S. Chand Publishing.
2. "Neville, A.M., Properties of concrete": ELBS, London
3. Concrete Technology, THIRD EDITION, Tata McGraw-Hill Education, 2004

Reference Book(s):

1. M L Gambhir, "Concrete manual", Dhanpat Rai and sons- New Delhi
2. N. Krishnaraju, "Concrete Mix deisgn: Sehgal – Publishers

Web and Video link(s):

- Cement: https://nptel.ac.in/courses/105102012/1
- Concrete production and fresh concrete: https://nptel.ac.in/courses/105102012/19
- Engineering properties of concrete https://nptel.ac.in/courses/105102012/23
- Concrete mix design: https://nptel.ac.in/courses/105102012/14
- Special concrete: https://nptel.ac.in/courses/105102012/36

COURSE ARTICULATION MATRIX (CONCRETE AND NON-DESTRUCTIVE TESTING LABORATORY – P22CVL406)															
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												1		
CO2	2	1											1		
CO3	1		3										2		
CO4	1	1			2									2	
3 – HIGH, 2 – MEDIUM, 1 - LOW															

EMPLOYABILITY ENHANCEMENT SKILLS - IV			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – IV for Civil, Mech, IP & Automobile Branches only			
Course Code:	**P22HSMC407A**	**Credits:**	**01**
Teaching Hours/Week (L:T:P)	0:2:0	**CIE Marks:**	**50**
Total Number of Teaching Hours:	30	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Calculations involving simple and compound interest, averages, alligations & mixtures, proportions, variations and partnership.
- Explain concepts behind logical reasoning modules of series, coding & decoding, seating and data arrangements.
- Develop problem solving through Python language.

UNIT – I		**06 Hours**

Quantitative Aptitude: Simple and Compound Interest, Averages.

Logical Reasoning: Series, Coding & Decoding.

Self-study component:	Mensuration

UNIT – II		**06 Hours**

Quantitative Aptitude: Alligations and Mixtures, Ratios, Proportions and Variations.

Logical Reasoning: Seating Arrangement, Data Arrangement.

Self-study component:	Types of cryptarithm

UNIT – III		**06 Hours**

Quantitative Aptitude: Partnership.

Verbal Ability: Sentence Completion, Ordering of Sentences.

Self-study component:	Game based assessments

UNIT – IV	**PYTHON - I**	**06 Hours**

Python Basics: The print statement, Comments, Python Data Structures and Data Types, String Operations in Python, Simple Input & Output, Simple Output Formatting, Operators in Python

Python Program Flow: Indentation, The If statement and its' related statement, An example with if and it's related statement, The while loop, The for loop, The range statement, Break & Continue, Assert, Examples for looping.

Functions and Modules: Create your own functions, Function parameters, Variable Arguments, Scope of a Function, Function Documentations, Lambda Functions & map, n Exercise with functions, Create a Module, Standard Modules.

Self-study component:	List-like types

UNIT – V	PYTHON - II	06 Hours

Exceptions Handling: Errors, Exception handling with try, handling Multiple Exceptions, Writing your own Exception.

File Handling: File handling Modes, Reading Files, Writing & Appending to Files, Handling File Exceptions, The with statement.

Classes in Python: New Style Classes, Creating Classes, Instance Methods, Inheritance, Polymorphism, Exception Classes & Custom Exceptions.

Generators and Iterators: Iterators, Generators, The Functions any and all, With Statement, Data Compression

Self-study component:	Debugging

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	Solve the problems based on simple and compound interests, averages, alligations & mixtures, ratios, proportions, variations and partnerships.	Applying	L3
CO2	Solve logical reasoning problems based on seating arrangements, data arrangement and verbal ability skills of sentence corrections and ordering of sentences.	Applying	L3
CO3	Apply suitable programming constructs of Python language and / or suitable data structures to solve the given problem.	Analyzing	L4
CO4	Design and Develop solutions to problems using functions.	Analyzing	L4

Text Book(s):
1. Python Programming: Using Problem Solving Approach by Reema Thareja.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015
3. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):
1. Al Sweigart, "Automate the Boring Stuff with Python", 1st Edition, No Starch Press, 2015.
2. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

Web and Video link(s):
- Learn Python by example - https://www.learnbyexample.org/python/

- Learn Python - https://www.learnpython.org/
- Python tutor: Visualize code in Python - https://pythontutor.com/visualize.html#mode=edit

COURSE ARTICULATION MATRIX

(EMPLOYABILITY ENHANCEMENT SKILLS - IV – P22HSMC407)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											2
CO2	2											2
CO3	2	2										
CO4	2	2										

Internship - I [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – IV**			
Course Code:	**P22INT409**	**Credits:**	**02**
Teaching Hours/Week (L:T:P):	0:0:2	**CIE Marks:**	-
Total Number of Teaching Hours:	-	**SEE Marks:**	**100**

All the students registered to II year of BE shall have to undergo a mandatory internship of 02 weeks during the intervening vacation of II and III semesters or III and IV semester. Internship shall include Inter / Intra Institutional activities. A Semester End Examination (Presentation followed by question-answer session) shall be conducted during IV semester and the prescribed credit shall be included in IV semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent Semester End Examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

PHYSICAL EDUCATION
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER - IV

Course Code:	P22PED409	Credits:	00
Teaching Hours/Week (L:T:P):	0:0:2	CIE Marks:	100
Total Number of Teaching Hours:	-	SEE Marks:	-

Fitness Components	Track Events
Athletics Track- Sprints Jumps- Long Jump Throws- Shot Put	1.1. Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. 1.2. Acceleration with proper running techniques. 1.3. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. **Long Jump**: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick) and Landing **Shot put**: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique.
Kho kho	A. **Fundamental skills** 1. Service: Under arm service, Side arm service, Tennis service, Floating service. 2. Pass: Under arm pass, Over head pass. 3. Spiking and Blocking. 4. Game practice with application of Rules and Regulations B. **Rules and their interpretation and duties of officials**.
Throw ball Athletics Track- 110 &400 Mtrs Hurdles Jumps- High Jump Throws- Discuss Throw	A. **Fundamental skills:** Overhand service, Side arm service, two hand catching, one hand overhead return,side arm return. B. **Rules and their interpretations and duties of officials** **110 Mtrs and 400Mtrs**: Hurdling Technique :Lead leg Technique, Trail leg Technique ,Side Hurdling, Over the Hurdles Crouch start (its variations) use of Starting Block. Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. **High jump**: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. **Discus Throw**: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).

YOGA			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER - IV			
Course Code:	**P22YOG409**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**-**	**SEE Marks:**	**-**

Course objectives:

6) To enable the student to have good health.
7) To practice mental hygiene.
8) To possess emotional stability.
9) To integrate moral values.
10) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
10. Improved body flexibility and balance
11. Improved cardiovascular endurance (stronger heart)
12. Improved digestion
13. Improved abdominal strength
14. Enhanced overall muscular strength
15. Relaxation of muscular strains
16. Weight control
17. Increased energy levels
18. Enhanced immune system
- Mental
4. Relief of stress resulting from the control of emotions

5. Prevention and relief from stress-related disorders
6. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
4. Life with meaning, purpose, and direction
5. Inner peace and tranquility
6. Contentment

Patanjali's Ashtanga Yoga, its need and importance.

Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha

Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan

Suryanamaskar12 count- 4 rounds of practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Sukhasana

       2. Paschimottanasana

b. Standing 1. Ardhakati Chakrasana

       2. Parshva Chakrasana

c. Prone line 1. Dhanurasana

d. Supine line 1. Halasana

       2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati.

40 strokes/min 3 rounds

Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama

Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodhana

Additional Mathematics - II			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – IV (Lateral Entry: Common to all branches)			
Course Code:	**P22MDIP401**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**-**

Course Objectives: The mandatory learning course**: P21MATDIP401** viz., **Additional Mathematics-II** aims to provide essential concepts of linear algebra, introductory concepts of second & higher order differential equations along with various techniques/ methods to solve them, Laplace & inverse Laplace transforms and elementary probability theory.

UNIT-I	
Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form of a matrix. Consistency of system of linear equations - Gauss elimination method. Gauss-Jordan and LU decomposition methods. Eigen values and Eigen vectors of a square matrix. **Self-study Components**: Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples.	**10 Hrs**

UNIT-II	
Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. and variation of parameters. Solution of Cauchy's homogeneous linear equation and Legendre's linear differential equation. **Self-study Components**: Method of undetermined coefficients	**14 Hrs**

UNIT-III	
Multiple Integrals: Double and triple integrals-region of integration. Evaluation of double integrals by change of order of integration. Vector Integration: Vector Integration: Integration of vector functions. Concept of a line integrals, surface and volume integrals. Green's, Stokes's and Gauss theorems (without proof) problems. **Self-study Components**: Orthogonal curvilinear coordinates.	**10 Hrs**

UNIT-IV	
Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function-Problems only. Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods. **Self-study Components**: Application to solutions of linear differential equations and simultaneous differential equations..	**12Hrs**

UNIT-V	
Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. **Self-study Components**: State and prove Bayes's theorem	**06Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply matrix theory for solving systems of linear equations in the different areas of linear algebra.
CO2:	Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations.
CO3:	Identify - the technique of integration evaluate double and triple integrals by change of variables, and vector integration technique to compute line integral
CO4:	Explore the basic concepts of elementary probability theory and, apply the same to the problems of decision theory,

Text Book:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.

Reference books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers,7th Ed., 2007.

Additional Communicative English - II			
[As per Choice Based Credit System (CBCS) & OBE Scheme]			
SEMESTER – IV			
Course Code:	P22HDIP407	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	0:2:0	**CIE Marks:**	**100**
Total Number of Teaching Hours:	30	**SEE Marks:**	**-**

Module-1	
Listening Skills II	**2 Hours**
Levels of listening, Active listening, Techniques of listening. Activity: Listening for main ideas and Listening for specific information	
Speaking Skills II	**6 Hours**
Language of discussion – Giving opinion, agreeing / disagreeing, asking questions, making suggestions. Sentence stress – content and structure words, Speaking situations, Intonations and Summarizing skills	

Module-2	
Reading Skills II	**2 Hours**
Guessing meaning from the context, Understanding graphical information, Summarizing. Activity: Book review	
Writing Skills II	**4 Hours**
Linkers and connectives, Sentence and paragraph transformation, Mind mapping techniques, Letter writing, Essay writing	

Module-3	
Email Etiquette	**4 Hours**
Parts of an email, Writing an effective subject line, email language and tone. Activity: Email writing practice - Scenario based emails	
Group Presentations	**2 Hours**
Group presentations by the students	

Module-4	
Goal Setting	**2 Hours**
Defining goals, types of goals, Establishing SMART goals, Steps in setting goals, Goal setting activity	
Individual Presentations	**4 Hours**
Individual presentation by the students	

Module-5	
Teamwork	**4 Hours**
Defining teams, Team vs. Group, Benefits and challenges of working in teams, Stages of team building, Building effective teams, Case studies on teamwork	

Course Outcomes: On completion of this course, students will be able to,

CO 1: Understand the role of communication in personal and professional success

CO 2: Comprehend the types of technical literature to develop the competency of students to apprehend the nature of formal communication requirements.

CO 3: Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence

CO 4: Demonstrate effective individual and teamwork to accomplish communication goals.

Textbooks and Reference Books:

1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press - 2015.
2. Everyday Dialogues in English by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
3. Developing Communication Skills by Krishna Mohan& Meera Banerjee (Macmillan)
4. The Oxford Guide to Writing and Speaking, John Seely, Oxford.
5. English Language Communication Skills - Lab Manual cum Workbook by Rajesh Kumar Singh, Cengage learning India Pvt Limited – 2018
6. The 7 habits of highly effective people by Stephen R Covey, Simon & Schuster – 2020
7. You Are the Team: 6 Simple Ways Teammates Can Go from Good to Great by Michael G. Rogers

CO – PO – PSO Matrix

CO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1												2			
CO 2										2					
CO 3										2					
CO 4									2						
CO									**2**	**2**		**2**			