

SYLLABUS

(With effect from 2018-19)

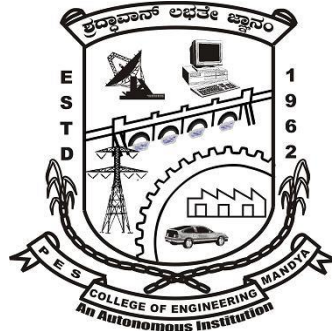
ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕವರ್ಷ 2018-19)

III & IV Semester

**Bachelor Degree
in
Civil Engineering**

**Out Come Based Education
with
Choice Based Credit System**



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, New Delhi

Approved by AICTE, New Delhi.

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಮಂಡ್ಯ-571 401, ಕರ್ನಾಟಕ

(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

Ph : 08232- 220043, Fax : 08232 – 222075, Web : www.pescemandya.org

PREFACE

P.E.S. College of Engineering, Mandya, started in the year 1962, has become autonomous institute in the academic year 2008-09. Since, then it has been doing the academics and assessment activities successfully. The college is running eight undergraduate and eight Postgraduate programs including MBA and MCA which are affiliated to VTU, Belagavi.

India has recently become a Permanent Member of the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degree globally but also establishes equivalence to our degrees with that of the member nations. The implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the various countries.

Our Higher Educational Institution has adopted the Choice Based Credit System (CBCS) based semester structure with OBE scheme and grading system. Which provides the flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. There lies a shift in thinking, teaching and learning process moving towards Students Centric from Teachers Centric education which enhances the knowledge, skills & moral values of each student.

Choice Based Credit System (CBCS) provides the options for the students to select from the number of prescribed courses. The CBCS provides a 'cafeteria' type approach in which the students can Choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach for learning which enables integration of concepts, theories, techniques. These are greatly enhances the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills, self learning components and Personality Development modules have been added to the existing curriculum. In order to enhance creativity and innovation Mini Project and Industrial visit & Interaction are made mandatory for all undergraduate programs.

Dr. Umesh D.R.
Deputy Dean (Academic)
Associate Professor,
Dept. of Computer Science & Engg.

Dr. Nagarathna
Dean (Academic)
Professor,
Dept. of Computer Science & Engg.

PES College of Engineering

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.

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.

III – Semester

Sl. No.	Course Code	Course Title	Teaching Department	Hrs. / Week			Credits	Examination Marks		
				L	T	P		CIE	SEE	Total
1	P18MA31	Transform calculus, fouries and numerical techniques	MA	4	-	-	4	50	50	100
2	P18CV32	Building Materials and Construction	Civil	3	-	-	3	50	50	100
3	P18CV33	Concrete Technology	Civil	3	-	-	3	50	50	100
4	P18CV34	Basic Surveying	Civil	3	-	-	3	50	50	100
5	P18CV35	Fluid Mechanics	Civil	3	-	-	3	50	50	100
6	P18CV36	Strength of Materials [Foundation course -1]	Civil	2	2	-	3	50	50	100
6	P18CVL37	Construction Materials Testing Laboratory	Civil	-	-	3	1.5	50	50	100
7	P18CVL38	Computer Aided Building Planning and Drawing	Civil	-	-	3	1.5	50	50	100
8	P18HU39	#Aptitude and Reasoning Development - Basics (ARDB)	HM	2	-	-	-	50	-	-
9	P18HUDIP310	*Comprehensive Communication Development (CCD)	HM	2	-	-	[2]	[50]	[50]	[100]
10	P18HUDIP311	*Indian Constitution, Human Rights & Professional Ethics (ICHRPF)	HM	2	-	-	-	(50)	-	-
11	P18MADIP31	*Additional Mathematics - I	MA	4	-	-	-	(50)	-	-
Total							22	400	400	800
Total							[24]	[450]	[450]	[900]

* CCD / ICHRPF / Additional Mathematics-I: **Lateral entry** (i.e. Diploma) students shall have to pass these mandatory learning courses before completion of VI- Semester. CIE only for 50 marks.
#ARDB: All students shall have to pass this mandatory learning courses before completion of VI- Semester
+ Common to BE (AU, CV, ME and I&PE)
++ Common to BE (CS, EC, E&E and IS&E)

IV – Semester

Sl. No.	Course Code	Course Title	Teaching Department	Hrs. / Week			Credits	Examination Marks		
				L	T	P		CIE	SEE	Total
1	P18MA41	Complex analysis, statistics, probability and numerical techniques	MA	4	-	-	4	50	50	100
2	P18CV42	Hydrology and Irrigation Engineering	Civil	3	-	-	3	50	50	100
3	P18CV43	Transportation Engineering	Civil	3	-	-	3	50	50	100
4	P18CV44	Advanced Surveying	Civil	3	-	-	3	50	50	100
5	P18CV45	Hydraulics & Hydraulic Machines	Civil	3	-	-	3	50	50	100
6	P18CV46	Basic Structural Analysis [Foundation course –II]	Civil	2	2	-	3	50	50	100
7	P18CVL47	Surveying Practice	Civil	-	-	3	1.5	50	50	100
8	P18CVL48	Hydraulics and Hydraulic Machines Laboratory	Civil	-	-	3	1.5	50	50	100
9	P18HU49	Aptitude and Reasoning Development - Intermediate (ARDI)	HM	2	-	-	1	50	50	100
10	P18EVDIP50	*Environmental Studies	HM	2	-	-	-	(50)	-	-
11	P17MADIP41	*Additional Mathematics - II	MA	4	-	-	-	(50)	-	-
Total							23	450	450	900

* **Additional Mathematics-II & Environmental Studies: Lateral entry** (i.e. Diploma) students shall have to pass these mandatory learning courses before completion of VI- Semester. CIE only for 50 marks.
+ Common to BE (AU, CV, ME and I&PE)
++ Common to BE (CS, EC, E&E and IS&E)

Course Title: TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES			
Course Code: P18MA31	Semester: III	L:T:P:H: 4:0:0:4	Credits: 4-0-0
Contact Period-Lecturer: 52Hrs.	Exam: 3Hrs	Weightage:CIE:50%; SEE:50%	

(Common to All Branches)

UNIT-I

Numerical Methods-I: Finite differences: Forward and Backward differences, Gregory- Newton forward and backward interpolation formulae, Newton's divided difference formula, Lagrange's interpolation formula and inverse interpolation formula. (All formulae without proof) – Problems only

Central differences: Gauss Forward and Backward difference formulae, Sterling's, and Bessel's formulae (All formulae without proof) – problems.

Self-Study Component: Problems using Everett's formula in Central differences

10 Hrs.

UNIT-II

Numerical differentiation using Newton's forward and backward interpolation formulae, Newton's divided difference formula and Sterling's formula (All formulae without proof)- problems only and Applications to Maxima and Minima of a tabulated function.

Numerical integration: Newton- Cotes quadrature formula, Trapezoidal rule, Simpson's ($\frac{1}{3}$)rd-rule, Simpson's ($\frac{3}{8}$)th rule, Boole's rule and Weddle's rule (All rules without proof)- Illustrative problems.

Self-Study Component: Derive Newton- Cotes quadrature formula.

10 Hrs.

UNIT-III

Fourier series: Periodic functions, Euler's formula, Dirichlet's conditions. Discontinuous functions, even and odd functions, functions of arbitrary intervals. Half-range Fourier series expansions, complex form of Fourier series, Practical harmonic analysis- Illustrative examples from engineering field.

Self-Study Component: Derivations of Euler's formulae

11 Hrs.

UNIT-IV

Fourier Transforms: Infinite Fourier transforms-properties. Fourier sine and cosine transforms, properties. Inverse infinite Fourier and inverse Fourier sine & cosine transforms –Illustrative examples.

Difference equations and Z-transforms: Definition, Z-transform of standard functions, linearity property, damping rule, shifting rules, initial value theorem and final value theorem (All rules and

theorems without proof). Inverse Z – transforms. Difference equations- basic definitions. Application of Z-transforms to solve difference equations.

Self-Study Component: Convolution theorem, Parseval's identities. related problems.

10 Hrs.

UNIT-V

Partial differential equations (PDE's):

Formation of PDE by eliminating arbitrary constants and functions. Solution of non-homogeneous PDE by the method of direct integration. Solutions of homogeneous PDE involving derivative with respect to one independent variable only (both types with given set of conditions). Method of separation of variables (first and second order equations). Solution of the Lagrange's linear PDE's of the type: $Pp + Qq = R$.

Applications of PDE's:

One- dimensional wave and heat equations (No derivation), and various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional

Laplace's equation (No derivation)–various possible solutions. Solution of all these equations with specified boundary conditions (Boundary value problems). Illustrative examples from engineering field.

Self-Study Component: Finding the solution of non-linear equations of first order: Char pit's Method -simple problem.

11 Hrs.

Text Books:

1. Higher Engineering Mathematics: B.S. Grewal, Khanna Publishers, New Delhi, 42nd Ed. 2012.
2. Advanced Engineering Mathematics: - E. Kreyszig, John Wiley & Sons, 6th Ed. 2007.

References:

1. Advanced Modern Engineering Mathematics: - Glyn James, Pearson Education Ltd., 3rd Ed., 2007.
2. Advanced Engineering Mathematics: Peter V O' Neil Thomson, Brooks/Cole, 5th edition, 2007.
3. Higher Engineering Mathematics: - B.V. RAMANA, McGraw Hill Education, 2007

Course Articulation Matrix

Mapping of Course Outcomes (CO) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Sem: 3	Course code : P18MAT31	Title : Engineering Mathematics –III											
CO's	Statement	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	PO 8	P O 9	PO 10	PO 11	P O 12
CO-1	Apply forward, backward difference formulae and central differences formulae in solving interpolation- extrapolation problems in engineering field.	1	2	-	-	-	-	-	-	-	-	-	-
CO-2	Numerical differentiation and integration rules in solving engineering where the handling of numerical methods are inevitable	2	2	-	-	-	-	-	-	-	-	-	-
CO-3	Apply the knowledge of periodic function, Fourier series, complex Fourier series, Fourier sine/cosine series of a function valid in different periods. Analyze engineering problems arising in control theory/fluid flow phenomena using harmonic analysis.	3	3	-	-	-	-	-	-	-	-	-	-
CO-4	Understand complex/infinite Fourier transforms, Fourier sine and Fourier cosine transforms with related properties Analyze the engineering problems arising in signals and systems, digital signal processing using Fourier transform techniques. Define Z-transforms & find Z-transforms of standard functions to solve the specific problems by using properties of Z-transforms. Identify and solve difference equations arising in engineering applications using inverse Z-transforms techniques.	2	3	-	-	-	-	-	-	-	-	-	-
CO-5	Define Partial Differential Equations (PDE's), order, degree and formation of PDE's and, to solve PDE's by various methods of solution Explain one - dimensional wave and heat equation and Laplace's equation and physical significance of their solutions to the problems selected from engineering field.	2	3	-	-	-	-	-	-	-	-	-	-

Note: - Each unit contains **two** full questions of **20 marks** each. Students are required to Answer any five full questions choosing at least **one** full question from each unit.

Course Title : Building Materials and Construction			
Course Code :P18CV32	Semester: III	L - T - P : H : 3-0-0: 3	Credits :03
Contact Period: Lecture: 52 Hrs	Exam Hours :03 Hr	Weight age: CIE:50; SEE:50	
Prerequisites : Nil			

Course Learning Objectives (CLOs)

This course aims to

1. Explain different types of construction materials.
3. Classify bonds in brick work, scaffolding, shoring, underpinning and types of flooring.
4. Explain different types of roofs, stairs, doors, windows and ventilators.
5. Explain purpose of plastering and methods of plastering and painting.

Course Content

UNIT-I

Building Materials: Qualities of good building stones, dressing of stones, classifications of bricks, manufacture of bricks, qualities of good bricks, 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. **12 Hrs**

UNIT-II

Foundation: Preliminary investigation of soil, bearing capacity of soil, safe bearing capacity of soil, methods of determining bearing capacity, methods of improving bearing capacity. 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. **10Hrs**

UNIT-III

Masonry arches and floors: Definition of terms used in masonry, bonds in brickwork, English bond, Flemish bond, reinforced brickwork, stone masonry, rubble masonry, coursed rubble masonry.

Arches: masonry arches, classification, stability of an arch, lintels, types and classifications, shoring, underpinning, scaffolding.

Floors: Types of flooring (materials and method of laying), mosaic, marble, polished granite, industrial flooring, flat roof (R.C.C.) **10 Hrs**

Self study component: Factors affecting selection of flooring materials,

UNIT – IV

Roofs, stairs, doors and windows: 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 **10Hrs**

UNIT- V

Plastering and painting: Purpose of plastering, materials of plastering, lime mortar, cement mortar, methods of plastering, stucco plastering, Purpose of painting, types of paints, application of paints to new surfaces, distemper, plastic emulsion, enamel, painting on iron and steel surfaces. Polishing of wood surface.

Introduction to cost effective construction, miscellaneous topics: Necessity, advantages, prefabrication techniques, pre-cast doors and windows (pre-cast frames and shutters)

Miscellaneous topics: Form work, form work details, RCC columns, beams floors.

Self study component: slip forming and damp proof construction. **10 Hrs**

Text Book:

1. B.C. Punmia, “Building Construction”, 10th Edition, Laxmi Publications, New Delhi, 2007.
2. S.C Rangwala., “Engineering Materials”, 28th Edition, Charotar Publishing House, Anand, 1997

Reference Books:

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.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Understand the properties and use of construction materials (PO1,PO2, PSO1)
2. To identify types of footing, RCC, raft foundations in different soils (P01, PO2,PS02)
3. To classify Bonds in brick work, English bond, Flemish bond, Joints in stone masonry, arches. (PO1, P02, PS02, PS01)
4. Tounderstand the building components and method of construction (P01, P02, PS01,PS02)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome- CO's	Program outcome												Program Specific outcome			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	
1	Understand the properties and use of construction materials.	2	3												2		
2	To identify types of footing, RCC, raft foundations in different soils.	2	2												1	2	
3	To classify Bonds in brick work, English bond, Flemish bond, Joints in stone masonry, arches.	2	3												1	2	
4	To understand the building components and method of construction .	2	3												1	2	

Course Title:: Concrete Technology			
Course code : P18CV33	Semester: III	L - T - P : H : 3-0-0: 3	Credits :03
Contact Period: Lecture: 52 Hrs		Exam Hours :03 Hr	Weight age: CIE:50; SEE:50
Prerequisites :Nil			

Course Learning Objectives (CLOs)

This course aims 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
4. Describe chemical admixtures and mineral admixtures.
5. Explain hardened concrete and its strength properties.

Course Content

UNIT – I

CONCRETE INGREDIENTS AND MICROSTRUCTURE: Cement – Chemical composition, hydration of cement, types of cement, manufacture of OPC with flow charts. Bogue’s compound, Tests on cement – field testing, fineness, normal consistency, setting time, soundness, and compressive strength (detailed procedures covered in laboratory). Quality of mixing water. Fine aggregate – grading of aggregates, sieve analysis, specific 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 (detailed procedures to be covered in laboratory)

Self-study component: Alkali- aggregate reaction, manufactured sand its significance.

12 Hrs

UNIT-II

RHEOLOGY OF FRESH CONCRETE: Workability – definition, factors affecting workability, measurement of workability by slump, compaction factor, Vee-bee, flow tests. Segregation and bleeding, process of manufacture of concrete – batching. Mixing, transporting, placing, compaction, curing of concrete. chemical admixtures – plasticizers, accelerator, retarders. Mineral admixtures – fly ash, blast furnace slag, meta-kaolin, GGBS

Self-study component: Mineral & chemical admixtures – Silica fumes and rice husk ash and air entraining agents.

10 Hrs

UNIT – III

HARDENED CONCRETE: Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, effect of aggregate properties, compressive strength, tensile strength, bond strength, modulus of rupture, modulus of elasticity, the relationship between these parameters, aggregate-

cement bond strength. Shrinkage – plastic shrinkage and drying shrinkage, factors affecting shrinkage. Creep – Measurement of creep, factors affecting creep, effect of creep.– compressive strength, non-destructive testing of concrete. (Split tensile strength, Flexural strength, Rebound hammer, Ultra sonic pulse velocity test, cover meter test.

Self-study component: Other NDT methods.

10 Hrs

UNIT – IV

RMC concrete - Manufacture, transporting, placing, precautions, Methods of concreting- Pumping, under water concreting, shotcrete, High volume fly ash concrete concept, properties, typical mix Self compacting concrete concept, materials, tests, properties, application and Typical mix.

Durability of concrete-introduction, permeability of concrete, chemical attack, Sulphate attack, acid attack, efflorescence, corrosion in concrete, thermal conductivity, thermal diffusivity, specific heat.IS456-2000 requirement for durability. Factors contributing cracks in concrete-plastic shrinkage, settlement cracks construction joints.

Self-study component: Codal provisions for durability of concrete, Introduction to current British (BS) code, Mix design by ACI code.

10 Hrs

UNIT-V

Progress in concrete Technology: Properties and uses of High strength Concrete, Polymer impregnated concrete, High performance concrete and Roller compacted concrete, Geo-polymer concrete, fibre-reinforced concrete, light weight concrete, Translucent concrete,

Self-study component: Bacterial concrete, Whisper concrete.

10 Hrs

Text Book:

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 Books:

1. Neville, A M, Properties of concrete, ELBS Publications.
2. IS: 10262 – Recommended guidelines for Concrete Mix design – BIS Publications.
3. Mehta PK, Properties of Concrete, ICI, Chennai

Note: Self-study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of science and engineering to acquire the fundamentals of cement, aggregates and admixtures.(PO1,PO12)
2. Conduct investigations to select suitable materials for concrete.(PO4,PO12)

Department of Civil Engineering

P.E.S College of Engineering, Mandya, (An Autonomous Institution under VTU)

3. Design special concrete as per selected codes.(PO3,PO12)
4. Apply the concept of durability of concrete for sustainability.(PO7,PO12)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome- CO's	Program outcome												Program Specific outcome		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
01	Apply the knowledge of science and engineering to acquire the fundamentals of cement, aggregates and admixtures.	2	3										1	2		
02	Conduct investigations to select suitable materials for concrete.	2	2										2	1	2	
03	Design special concrete as per selected codes.	2	3										3	1	2	
04	Apply the concept of durability of concrete for sustainability.	2	3										1	1	2	

Course Title:: Basic Surveying			
Course code : P18CV34	Semester: III	L - T - P : H : 3-0-0: 3	Credits :03
Contact Period: Lecture: 52 Hrs	Exam Hours :03 Hr	Weight age: CIE:50; SEE:50	
Prerequisites :Nil			

Course Learning Objectives (CLOs)

This course aims to

1. Classify and identify basic principles of surveying and describe chain surveying and its operations.
2. Determine bearings and internal angles using compass for traversing.
3. Determine different types of levelling and to prepare data of levelling.
4. Understand characteristics of contours and calculating area and volume.
5. Understand the features of theodolite and illustrate tachometric surveying using different methods.

Course Content

UNIT – I

Introduction: Definition of surveying, classification of surveys, basic principles of surveying, uses of surveying units of measurements, errors, classification, precision and accuracy. Map and classification, survey of India topographical maps and their numbering.

Chain Surveying; Chain and types, tape and types, ranging of lines, direct and indirect accessories required, selection of stations and lines, offsets and types setting out of right angles, use of optical square, prism square, cross staff, linear methods of setting out right angles, , obstacles in chain survey. Measurement of distances over sloping grounds, chain and tape corrections - numerical problems.

Self study component: Booking of chain survey work, field book entries, and conventional symbols.Errors in chain survey and precautions to be taken. **12 Hrs**

UNIT-II

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, interior angles, dip and declination, local attraction-numerical problems.

Traverse Survey: Closed and open traverse, checks for closed traverse and concept of latitude and departure, determination of closing error and its direction,omitted measurements.

Self study component: Bowditch's rule and transit rule,Bowditch's graphical method of adjustment of closed traverse. **10 Hrs**

UNIT-III

Introduction to Levelling : Principles and basic definitions, fundamental axes and relationship and parts of a dumpy level, types of adjustments and objectives, temporary adjustments of a dumpy level,curvature and refraction correction, types of leveling-simple levelling, reciprocal levelling, profile levelling, cross sectioning, fly levelling.

Reduction of Levelling: Booking of levels, rise and fall method and height of instrument method, comparison, arithmetic checks, fly back levelling, Numerical problems.

Self study component: Sensitiveness of bubble tube, Errors and precautions of levelling.

10 Hrs

UNIT-IV

Contouring: Contours and their characteristics, methods of contouring, direct and indirect methods, interpolation techniques, uses of contours, and numerical problems on determining inter visibility, grade contours and uses.

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, Measurement of volume-trapezoidal and prismatic formula.

Self study component: EDM Devices, planimeter, hand level, Ceylon ghat tracer, Abney level

10 Hrs

UNIT – V

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, measurements of vertical angles.

Tacheometric Surveying : Basic principle, types of tachometric survey, tachometric equation for horizontal line of sight and inclined line of sight in fixed hair method, anallactic lens in external focusing telescopes, reducing the constants in internal focusing telescope.

Self study component: Moving hair method and tangential method, Subtense bar.

10 Hrs

Text Book:

1. Surveying, Vol-1 - B.C. Punmia, Laxmi Publications, New Delhi.
2. Plane Surveying, Vol-1-A.M. Chandra, Newage International ® Ltd.

Reference Books:

1. Plane Surveying, ALAK, S. Chand and Company Ltd., New Delhi.
2. Fundamentals of Surveying - Milton O. Schmidt - Wong, Thomson Learning.
3. Fundamentals of Surveying - S.K. Roy - Prentice Hall of India.
4. Surveying Vol. I, S.K. Duggal, Tata McGraw Hill - Publishing Co. Ltd., New Delhi. *
Survey of India Publication on maps

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

Students will be able to

1. Apply the knowledge of basic surveying and mathematics for measurements of distance and angles using conventional surveying equipments. (PO1, PO12, PSO1)
2. Conduct traversing to plot the area and locate the objects on the drawing using chain, tape, compass. (PO2, PO12, PSO2)
3. Prepare the contour plans to estimate area and volume and to determine distance & elevation by tachometric surveying. (PO3, PO12, PSO2)
4. Interpretation of the data of leveling, theodolite surveying to measure the elevation and distances. (PO4, PO12, PSO2)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome(PO)												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of basic surveying and mathematics for measurements of distance and angles using conventional surveying equipments.	2											1	1		
02	Conduct traversing to plot the area and locate the objects on the drawing using chain, tape, compass.		2										2		2	
03	Prepare the contour plans to estimate area and volume and to determine distance & elevation by tachometric surveying.				3								1		2	
04	Interpretation of the data of leveling, theodolite surveying to measure the elevation and distances.				3								2		2	

Course Title : Fluid Mechanics			
Course Code : P18CV35	Semester: III	L - T - P : H : 3-0-0: 3	Credits :03
Contact Period: Lecture: 52Hrs	Exam Hours :03 Hr	Weight age: CIE:50; SEE:50	
Prerequisites: Physics and Engg. Mechanics			

Course Learning Objectives (CLOs)

This course aims to

1. Define the concept of fluid, its relevance in civil engineering and classify fluids based on physical properties.
2. Understand hydrostatic pressure and its measurement.
3. Differentiate between kinematic fluid and dynamic fluid flow.
4. Understand flow through pipes and losses due to flow through pipes.
5. Demonstrate flow measurement

Course Content

Unit-I

Introduction: Scope and importance of subject, its relevance in civil engineering, definition of fluid, distinction between solids and fluid, distinction between liquid and gas, fluid continuum, classification of fluids - Newtonian and Non-Newtonian fluids, ideal and real fluids.

Fluid properties : Mass density, specific volume, specific weight, relative density, viscosity, Newton's law of viscosity (with units and dimensions) and problems, compressibility, vapour pressure, surface tension, equation for stability of bubble and droplet of liquid, capillarity theory and problems.

Self study component: Rheology of fluids

12 Hrs

Unit-II

Fluid pressure and its measurement: Definition of pressure, units and dimensions, pressure at a point, Pascal's law, hydrostatic pressure law, atmospheric pressure, gauge pressure and absolute pressure. Measurement of pressure, simple manometer theory and problems, differential manometer theory and problems.

Hydrostatics: Definition of total pressure, center of pressure, centroid, centroidal depth, depth of center of pressure, equation for hydrostatic force and depth of center of pressure on plane surfaces (horizontal, vertical and inclined) and problems, hydrostatic force on submerged curved surfaces and problems, pressure diagram, problems.

Self study component: Mechanical pressure gauges.

10 Hrs

Unit-III

Kinematics of fluids: Description of fluid flow, Lagrangian and Eulerian approaches, classification of flow, definition of path line, streamline, streak line, stream tube, continuity equation, derivation of continuity equation in differential form, problem on continuity equation, definition of velocity potential, stream function, equipotential line, relation between velocity potential and stream function. Numericals/

Dynamics of fluid flow: Concept of inertia force and other forces causing motion, derivation of Euler's equation and Bernoulli's equation with assumptions and limitations, kinetic energy correction factor. Modification of Bernoulli's equation, problem on Bernoulli's equation with and without losses, application of Bernoulli's equation - venturimeter and pitot tube, momentum equation, problems.

Self study component: Flownets.

10Hrs

Unit-IV

Flow Through pipes: Flow through pipes, Reynolds number, definition of hydraulic gradient, energy gradient, major and minor losses in pipe flow, equation for head loss due to friction (Darcy-Weisbach equation), minor losses (types and equations) - problem on minor and major losses. Pipes in series, pipes in parallel and equivalent pipe- problems. Water hammer - equation for rise in pressure due to sudden and gradual closure of valve (no derivation) and problems.

Self study component: Pipe Network

10 Hrs

Unit-V

Flow Measurement: Flow through orifices, classification, vena- contracta and discharge through an orifice. Hydraulic co-efficient of an orifice and relation between them, equation for co-efficient of velocity, problems on hydraulic coefficients. Submerged and large rectangular orifices. Flow through mouth pieces, classification, and equation for discharge and pressure head for an external cylindrical mouth piece.

Flow over notches: Nappe - Types of Nappe. Classification and equation for discharge over rectangular, triangular and trapezoidal and, Cipolletti notches- problems. Broad crested weir- problems, submerged weirs, equation for discharge, problems, and ventilation of weirs

Self study component: Proportional weirs.

10Hrs

Text Books:

1. Hydraulics and Fluid Mechanics by P.N. Modi and S.M. Seth, Standard Book House, New Delhi.
2. Fluid Mechanics and Hydraulic Machines by Dr. R.K. Bansal, Lakshmi Publications, New Delhi.

Reference Books:

1. Fluid Mechanics, by Jain, A.K., Khanna Publishers, New Delhi.
2. Fluid Mechanics and Machinery by Ramamrutham, Dhanpat Rai Publishing company, New Delhi.
3. Elementary Hydraulics (1st Edition) James F Cruise, Vijay P. Singh, Mohsan M. Sherif, Thomson Learning.
4. Fluid Mechanics, Hydraulic and Hydraulics by K.R. Arora, Standard Book House, New Delhi.
5. Fluid Mechanics, John F. Douglas et al., Pearson Education, India.

Note: Self-study is for 5 marks only in CIE and not in SEE

Course Outcomes (COs)

1. Apply the knowledge of basic science and mathematics to differentiate a fluid and a solid, understand fluid properties, differentiate pressure and pressure head, analyze the fluid particles at rest or in motion and to understand flow measurement phenomenon. (PO1,PSO1,PSO2)
2. Formulate, interpret and analyze flow problems related with fluid particles either at rest or at motion. (PO2, PO3,PSO2,PSO3)
3. Identify and quantify losses in a flow phenomenon for the efficient design of pipe line and various flow measuring devices. (PO3, PO11, PSO1, PSO2)
4. Apply the knowledge of fluid mechanics in future to find efficient solutions to various problems related to civil engineering either as an individual or as a team member to Satisfy the changing professional and societal needs. (PO5, PO9, PO11, PSO1, PSO2)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome												PSO			
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
01	Apply the knowledge of basic science and mathematics to differentiate a fluid and a solid, understand fluid properties, differentiate pressure and pressure head, analyze the fluid particles at rest or in motion and to understand flow measurement phenomenon.(PO1,PSO1,PSO2)	1													1	2	
02	Formulate, interpret and analyze flow problems related with fluid particles either at rest or at motion. (PO2, PO3,PSO2,PSO3)		3	2												2	2
03	Identify and quantify losses in a flow phenomenon for the efficient design of pipe line and various flow measuring devices. (PO3, PO11, PSO1, PSO2)			3								2			1	2	
04	Apply the knowledge of fluid mechanics in future to find efficient solutions to various problems related to civil engineering either as an individual or as a team member to satisfy the changing professional and societal needs. (PO5, PO9, PO11, PSO1, PSO2)					3				2		1			1	2	

Course Title:: Strength of Materials [Foundation Course]			
Course Code: P18CV36	Semester: III	L - T - P : H : 2-2-0: 3	Credits :03
Contact Period: Lecture: 52 Hrs	Exam Hours :03 Hr	Weight age: CIE:50; SEE:50	
Prerequisites :Nil			

Course Learning Objectives (CLOs)

This course aims to

1. Understand the concept of deformable bodies and elastic properties of engineering materials.
2. Explain the concept of compound stresses, construct and interpret Mohr's circle for two dimensional stress systems.
3. Construct BMD & SFD for beams subjected to gravity loads and their combinations.
4. Apply the concept of simple bending theory for analysis of beams of rectangular, symmetrical I section, T section and circular section subjected to bending moment and shear force.
5. Analyse the shafts and elastic stability of columns.

Course Content

Unit-I

Simple stress and strain: Introduction to simple stresses and strains- direct stresses and shear stresses, linear 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. Elongation of uniform bar, tapering bars of circular and rectangular cross sections subjected to external loads. Elongation of uniform bar and tapering bar due to self weight. Compound bars subjected to external loads. Principle of super position. Elastic constants and relationship between them. Expression for volumetric strain. Thermal stresses in uniform bars and compound bars. Numericals.

Self Study: Stress – strain curve for High Yield strength Bars including salient features

12 Hrs

Unit-II

Compound stresses: Introduction, general two dimensional stress system, principal planes and principal stresses. Normal stress and tangential stress on an inclined plane in a general 2-D stress system. Equations for principal planes and principal stresses. Equation for planes of maximum shear stress and the value of maximum shear stress in 2-D stress system. Mohr's circle of stresses. Numericals.

Thick and thin cylinders: Introduction to thin and thick cylinders. Equation for longitudinal stress and circumferential stress in thin cylinders subjected to internal pressure. Efficiencies of joints in thin cylinders. Equation for Longitudinal strain, circumferential strain and volumetric strain in thin cylinders subjected to internal pressure. Variation of stresses in case of thick cylinders. Equation for radial stress and hoop stress in case of thick cylinders (Lame's Equations). Numericals.

Self Study: Thin cylinders with hemispherical ends.

10 Hrs

Unit-III

Bending moment and shear force in beams: Introduction to statically determinate beams, types of beams and types of loads. Shear force, bending moment point of contra flexure. Relationship between shear force, bending moment and intensity of loading. Computation of shear force and bending moment. Sketch SFD and BMD. Numericals on SFD, BMD and Point of contra flexure for cantilevers, simply supported beams and overhanging beams subjected to gravity loads and

couple.

Self Study: SFD and BMD for beams with intermediate hinges.

10 Hrs

Unit-IV

Stresses in Beams: Introduction to bending stresses in beams, simple bending theory, assumptions, pure bending, Neutral axis, derivation of Bending equation, moment of resistance and section modulus. Numericals on beams of uniform cross sections. Shear stresses in beams, distribution of shear stress in beam of rectangular, circular section, symmetrical I section and T section. Numericals.

Self Study: Beams of Uniform strength.

10Hrs

Unit-V

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, derivation of equations for Euler's buckling load for different end conditions (Both ends hinged, one end fixed and the other end free, Both ends fixed and One end fixed and the other is hinged), limitations of Euler's theory and Numericals. Rankine's theory and Numericals on Rankine's Theory.

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. Numericals.

Self Study: Composite shafts

10 Hrs

Text Book:

1. Strength of Materials: R Subramanian, Oxford University Press, Edition 2005
2. Mechanics of Materials: B.C Punmia, Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi.
3. Strength of Materials: B S Basavarajaiah and P Mahadevappa, CBS Publishers, New Delhi.

Reference Books:

1. Strength of Materials: Singer Harper and Row Publications.
2. Mechanics of Materials: Gere and Timoshenko

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes (COs)

1. Apply the knowledge of basic science and mathematics to understand the concepts of stress at a point, strain at a point, and the stress-strain relationships for linear, elastic, homogeneous, isotropic materials. (PO1,PSO1,PSO2,PSO3)
2. Analyse structural members subjected to tension, compression, torsion, bending, combined stresses and internal pressure using the fundamental concepts of stress, strain, elastic behavior of materials and sketch BMD and SFD. (PO2,PSO1,PSO2)
3. Compute the stresses and strains in members subjected to tension, compression, torsion, bending, combined stresses and internal pressure. (PO1, PO11,PO12, PSO2)

Department of Civil Engineering

P.E.S College of Engineering, Mandya, (An Autonomous Institution under VTU)

4. Apply the knowledge of strength of materials in future to work effectively either as an individual or as a team member to satisfy the changing professional and societal needs. (PO3, PO7, PO9, PO11, PO12, PSO1)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome												PSO					
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
01	Apply the knowledge of basic science and mathematics to understand the concepts of stress at a point, strain at a point, and the stress-strain relationships for linear, elastic, homogeneous, isotropic materials.	3															3	1	3
02	Analyze structural members subjected to tension, compression, torsion, bending, combined stresses and internal pressure using the fundamental concepts of stress, strain and elastic behavior of materials.		3														3	2	
03	Compute the stresses and strains in members subjected to tension, compression, torsion, bending, combined stresses and internal pressure.	3										2	3				3		
04	Apply the knowledge of strength of materials in future to work effectively either as an individual or as a team member to satisfy the changing professional and societal needs.			3				2		1		1	2	3					

Course Title:: Construction Materials Testing Laboratory			
Course Code: P18CVL37	Semester: III	L - T - P : H : 0-0-3: 3	Credits :1.5
Contact Period: Lecture: 39Hrs	Exam Hours :03 Hr	Weight age: CIE:50; SEE:50	
Prerequisites : Strength of Materials, Building materials and concrete Technology			

Course Learning Objectives (CLOs)

This course aims to

1. Conduct tension test on mild steel and HYSD bars, compression test of mild steel, cast iron and wood.
2. Conduct bending test on wood under two point loading.
3. Conduct shear test on mild steel.
4. Conduct impact test on mild steel (Charpy and Izod)
5. Conduct basic tests regarding ingredients of concrete.

Course Content

Experiments

1. Tension test on HYSD bars.
2. Compression test on mild steel & cast iron.
3. Bending test on wood under two point loading.
4. Double Shear test on mild steel.
5. Impact test on mild steel (Charpy and Izod)
6. Hardness tests on ferrous and non-ferrous metals - Brinell's, Rockwell and Vickers tests.
7. Test on bricks and tiles
8. Tests on fine aggregates- moisture content, specific gravity, bulk density, sieve analysis and bulking.
9. Tests on coarse aggregates - absorption, moisture content, specific gravity, bulk density and sieve analysis.

Self study component: Compression test of mild steel, Demonstration of strain gauges and strain indicators

Text Book:

1. Testing of Engineering Materials, Davis, Troxell and Hawk, International Student Edition - McGraw Hill Book Co. New Delhi.
2. Mechanical Testing of Materials, Fenner, George Newnes Ltd, London.

Reference Books:

1. Experimental Strength of Materials, Holes K A, English Universities Press Ltd. London.
2. Concrete Manual M.L.Gambhir -DhanpatRai& Sons- New Delhi. Scheme of Examination

Course Outcomes (COs)

1. Apply the basic knowledge of mathematics, science and engineering in finding the strength in tension, compression, flexure, shear and impact. (PO1,PO4,PO5,PO9,PO12,PSO2)
2. Develop an understanding of materials selection, based on mechanical properties and their applications.(PO2,PO3,PSO3)
3. Apply the basic knowledge of mathematics, science and engineering and evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to undesirable material.(PO2,PO6,PO12,PSO2)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome												PSO				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
01	Apply the basic knowledge of mathematics, science and engineering in finding the strength in tension, compression, flexure, shear and impact.	2			2	2								1			2	
02	Develop an understanding of materials selection, based on mechanical properties and their applications.		2	2										2				2
03	Students will evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to undesirable material.		2				2							1			2	

Course Title : Computer Aided Building Planning And Drawing			
Course code :P18CVL38	Semester: IV	L - T - P : H : 0-0-3: 3	Credits :1.5
Contact Period: Lecture: 39Hrs	Exam Hours :03 Hr	Weight age: CIE:50; SEE:50	
Prerequisites :NIL			

Course learning objectives (CLO's)

This course aims to

1. To get hands on experience in using Auto CAD.
2. To develop the ability to prepare layout, plan, section and elevation, functional units of different building types.
3. To gain the knowledge of building of building orientation standards, byelaws as per local bodies and know standards as per National Building code.

Course Content

Unit-I

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.

06 Hrs

Unit-II

To prepare working drawing of components of buildings i) Stepped wall footing ii) Fully paneled and flush doors iii) half paneled and half-glazed window

09Hrs

Unit-III

Functional design of building (Residential, Public and Industrial), positioning of various Components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio.

06Hrs

Unit-IV

Development of plan, elevation, section and schedule of openings from the given line diagram of residential buildings i) Two bed room building ii) Two storied building.

12 Hrs

Unit-V

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

03 Hrs

Unit-VI

For a given single line diagram, preparation of water supply, sanitary layouts

03 Hrs

Text Book:

1. Building Drawing: Shah M.H and Kale C.M, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Building Construction by Guru Charan Singh, Standard Publishers & distributors, New Delhi.
3. AutoCAD reference guide by Dorothy Kent

Reference Books:

1. National Building Code, BIS, New Delhi.

Course Outcomes (COs)

2. Develop bubble diagram and single line diagram for the given details using AUTO CAD. (PO 1,2,3,5,6,8,11,12, PSO 1,2,3)
3. Prepare plan and develop the elevation and cross sectional details for the given building plan using AUTO CAD. (PO 1,2,3,5,12, PSO 1,2,3)
4. Draw the functional requirements like water supply and sanitary layouts using AUTO CAD. (PO 1,2,3,5,6,8,11,12, PSO 1,2,3)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Develop bubble diagram and single line diagram for the given details using AUTO CAD	2	1	3		3	2		2			2	2	2	2	3
02	Prepare plan and develop the elevation and cross sectional details for the given building plan using AUTO CAD	2	1	3		3						2		1	2	3
03	Draw the functional requirements like water supply and sanitary layouts using AUTO CAD	2	1	3		3	2		2			2	2	2	2	3

Course Title: Aptitude and Reasoning Development - BEGINNER. (ARDB)			
Course Code : P18HU39	Semester : III	L-T-P-H : 2-0-0-2	Credits: NA
Contact Period: Lecture: 32 Hr. Exam: 3 Hr		Weightage :CIE:100% - [P/NP]	

Prerequisites: Basics of mathematics.

Course Learning Objectives (CLOs)

This course aims to

1. Solve the mathematical calculations easily and quickly using the methods of vedic mathematics.
2. Illustrate different examples to learn about percentages effectively.
3. Compare the different types of series.
4. Explain the logic behind solving problems under series such as A.P.,G.P.,H.P.
5. Explain divisibility rules, properties of different types of numbers.
6. Explain methods to find the number of factors and sum of factors.
7. Analyze the concept of power cycle, and find last digit and last two digits.
8. Solve problems involving simple equations and inequalities.
9. Explain Componendo, Dividendo, Invertendo, Alternendo and other terms related to ratio and proportion.
10. Explain the concepts behind the logical reasoning modules such as arrangement, blood relations and directions

Relevance of the course:

3rd Semester is considered as the right time to build a base to a student's analytical and logical ability. This course connects the basics of maths learnt in school into the present problem solving techniques. It creates an awareness towards the importance and significance of an individual's logical abilities.

Course Content

UNIT – I

Sharpen your axe!!

Vedic mathematics:

Viniculum and de- viniculum, subtractions using viniculum .Nikhilum multiplication: For numbers close to base values, multiplication of any two digit numbers or three digits number using criss cross method. Finding the square, square root, cubes , cube root of two digit and three digit numbers quickly. Approximation in multiplication and division. Checking the answer using digital sum method

SSC- Get hands on multiplication tables, increasing the speed in basic arithmetic operations. Classification of numbers.

Percentage calculations and ratio comparison:

Percentage calculations: Percentage rule for calculating, percentage values through additions, percentage– fraction table, approximation in calculating percentages. Application based problems

Ratio comparison: calculations method for ratio compressions: 1. the cross multiplication method, 2. percentage value compression method 3. Numerator and denominator percentage change method. Method for calculating the value of percentage change in the ratio. Application based problems.

SSC- Thorough with fractions and decimal values. Applications of tabulated fractions. Product of means and extremes.

8 Hrs

UNIT – II

Analytical Reasoning 1: series

Number series: Standard patterns of number series, pure series: perfect square, square cube, prime, combination of this series. Difference series, ratio series, mixed series, geometric series, two-tier arithmetic series, three-tier arithmetic series, change in the order for difference series, change in the order for ratio series, sample company questions.

Letter series: Alphabet and Alphanumeric series, finding the missing term based on logic learnt in number series module, continuous pattern series, correspondence series. sample company questions.

Picture series : image analysis, addition deletion rotation or modification of lines or shapes. Understanding the symmetry of the image. Mirror image analysis. sample company questions.

SSC- Basic knowledge of letter positions, Different number series for example – even, odd, prime, composite etc

6 Hrs

UNIT – III

Number system:

Introduction, **Integers:** Remainder zero concept, Odd and Even Integers, Negative and positive integers, power number a^x , properties of a perfect square number. **Prime number:** General method to identify the prime number, properties of prime numbers. Euler's number. **Factorial number:** Wilson's theorem, important results on factorial. **Divisor:** number of divisors, sum of divisors, number expressed as the product of two factors.

Divisibility rules: divisibility of a whole number by a whole number, divisibility of an expression by an expression. **Modulus concept:** divisibility rules in modulus, rules of operations in modulus.

Finding one remainder: One divisor, remainder of $(a^n - b^n)$, remainder for more than one divisor.

UNIT digit: Concept of power cycle, finding last two digits. Number of trailing zeroes.

SSC-Basic arithmetic operations, knowledge about quotient and remainders, multiples and factors.

6 Hrs

UNIT – IV

Simple equations, Ratio Proportions and Variations:

Simple equations: Linear equations-Linear equations in one variable, linear equation in two variables, Different methods of solving linear equations in two variables– Method of elimination, Method of substitution, Method of cross multiplication. Format of equations that can be converted to linear equations, Linear equations of three variables, Inequalities and its properties. Advanced problems on Simple equations. Age problems.

Ratio Proportions and Variations: Understanding the meaning and difference between ratio, proportion and variation. Properties of ratio, Comparison of more than two quantities, Proportion, Properties of proportion - Componendo, Dividendo, Invertendo, Alternendo. Continued proportion, Mean proportion. Variation - Direct variation, Indirect variation, Joint variation, Short cut methods to solve problems on variation.

SSC-Knowledge about factors, types of factors. Splitting the middle term rule, formula rule.

6 Hrs

UNIT – V

Building the fundamentals of logical reasoning:

Arrangement:

Approach to tackle questions, Different types of arrangement– Linear arrangement, Circular arrangement. Selection, Double line map. Possible ways of arrangement– Words or numbers, left side only, right side only, left right alternate, increasing or decreasing order, interchange vs push, Strategy for solutions– some tips for quick answers, general strategy.

Directions:

Basics. Pythagorean theorem, Pythagorean triplets, Solving problems for practice.

Blood relations:

Some typical relations that we come across, family tree, Structuring the given problem step by step. Suggested methods– Backtracking, drawing family tree. Problems on blood relations and professions.

SSC-Basic knowledge of directions, Pythagoras theorem. Logical reasoning skills, Relations, Family tree. **6 Hrs**

Reference Books:

1. The Trachtenberg speed system of basic mathematics, published by Rupa publications.
2. CAT Mathematics by Abhijith Guha. Published by PHI learning private limited.
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.
5. Quantitative aptitude for CAT by Arun Sharma, published by McGraw Hill publication.
6. Analytical reasoning by M.K Pandey BSC PUBLISHING.CO.PVT.LTD

Course Outcomes

After learning all the UNITs of the course, the student is able to:

1. Solve mathematical calculations in less duration compared to the conventional method. L2
2. Give examples for AP, GP and HP and differentiate between them. L1
3. Apply divisibility rules, power cycle method and evaluate the significance of the number system module. L2
4. Point out the errors in the problems concerning inequalities and solve simple equations and problems based on ratio, proportion and variation. L5
5. Solve the problems based on blood relations, directions and arrangement. L4

Course Title : Additional Mathematics -I			
Course Code : P18MADIP31	Semester : 3	L:T:P:H : 4:0:0:4	Credits: 0
Contact Period: Lecture: 52 Hr.		Weightage: CIE (max:50)	

((Mandatory Learning Course: **Common to All Branches**)
(A Bridge course for Diploma qualified students of III Sem. B. E.)

UNIT –I

Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram,

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. **12Hrs**

UNIT –II

Differential Calculus: Polar curves –angle between the radius vector and the tangent pedal equation-Problems. Maclaurin's series expansions- Illustrative examples.

Partial Differentiation: 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- Leibnitz's theorem (without proof). Application to Jacobians, errors & approximations. **10 Hrs**

UNIT –III

Integral Calculus: Statement of reduction formulae for $\sin^n x$, $\cos^n x$, and $\sin^m x \cos^n x$ 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**

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 42nd Ed. 2012.

References:

- 1.E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 6th Ed., 2007.
- 2.N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.

Course Title: COMPLEX ANALYSIS, STATISTICS, PROBABILITY AND NUMERICAL TECHNIQUES			
Course Code: P18MA41	Semester: IV	L:T:P:H: 4:0:0:4	Credits: 4-0-0
Contact Period-Lecturer: 52Hrs. Exam: 3Hrs		Weightage: CIE:50%; SEE:50%	

(Common to all Branches)

UNIT-I

Numerical Methods-II: Solution of algebraic and transcendental equations: Bisection method, Regula-Falsi & Newton-Raphson method. Fixed point iteration method: Aitken's Δ^2 - process - Illustrative examples only. Numerical solution of ordinary differential equations (ODE's): Numerical solutions of ODE's of first order and first degree – Introduction. Taylor's series method. Modified Euler's method, Runge - Kutta method of fourth order, Milne's and Adams-Bashforth predictor & corrector methods (All formulae without proof). Illustrative examples only.

Self-Study Component: Solution of second order ordinary differential equations using Runge-Kutta methods. Solution of first order simultaneous differential equations. **10 Hrs.**

UNIT-II

Numerical methods for system of linear equations- Gauss-Jacobi and Gauss- Seidel iterative methods. Relaxation method. Determination of largest Eigen value and corresponding Eigen vector by power method. Series solutions of ODE's and 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 $J_{\frac{1}{2}}(x)$ and $J_{-\frac{1}{2}}(x)$. Series solutions of Legendre's differential equation leading to $P_n(x)$ - Legendre's polynomials. Rodrigue's formula (No Proof) - simple illustrative examples.

Self-Study Component: Basics of Series solutions of ODE's; [analytic](#), singular point and basic recurrence relations. **10 Hrs.**

UNIT-III

Complex Analysis: Introduction to functions of complex variables. Definitions- limit, continuity and differentiability. Analytic functions. Cauchy - Riemann equations in Cartesian and polar forms (no proof). Construction of analytic function using Milne-Thomson method. Harmonic functions –Problems. Applications of analytic function to flow problems. Conformal transformation – Definitions and Discussion of Transformations: $w=z^2$, $w =e^z$ and $w= z + \frac{1}{z}$ ($z \neq 0$) and related problems. Bilinear transformation.

Self-Study Component: Derivation of Cauchy- Riemann equation in Cartesian and polar form.

11 Hrs.

UNIT-IV

Complex integration: complex line integrals. Cauchy theorem, Cauchy integral formula. Taylor's and Laurent's series (Statements only) and illustrative examples. Singularities, poles and residues. Cauchy residue theorem (statement only). Illustrative examples. Statistics: Brief review of measures of central tendency and dispersion. Moments, skewness and kurtosis. Curve fitting – least square method : $y = a + bx$; $y = ax^b$, $y = ab^x$ and $y = ax^2 + bx + c$. Correlation and **regression**.

Self-Study Component: Derivation of Cauchy theorem, Cauchy integral formula and Cauchy's residue theorem. Fit an equation of the **curves** of the type : $y = ae^{bx}$, **11 Hrs.**

UNIT – V

Probability Theory: Brief review of elementary probability theory. Random variables (discrete and continuous)-Introduction to probability distributions- probability mass/density functions and cumulative probability density functions – Illustrative examples. Discrete probability distributions- Binomial and Poisson's distributions; Continuous probability distributions - exponential and normal distributions. (No derivation of mean and variance). Illustrative examples from engineering and industrial fields. Joint probability distributions and Markov chains: Concept of joint probability. Joint probability Distributions of discrete random variables. Expectation, Covariance, correlation coefficient – illustrative Examples. Continuous joint probability distributions. Probability vectors, stochastic matrices. Fixed point and regular stochastic matrices.

Self-Study Component Basic definitions of probability and problems up to Bayes' theorem.

Derivation of Mean and SD of Binomial &Poisson distribution. **10 Hrs.**

Text Books:

- 1. Higher Engineering Mathematics:** B.S. Grewal, Khanna Publishers, New Delhi, 42nd Ed. 2012.
- 2. Advanced Engineering Mathematics:** - E. Kreyszig, John Wiley & Sons, 10th Ed., 2011

References:

1. T. Veerarajan: **Engineering Mathematics, Tata McGraw-Hill Pub., 2003.**
- 2. Introductory Methods of Numerical Analysis:** - S.S.Sastry, PHI, 3rd Ed.2000.
- 3. Linear Algebra and its applications:** - David C.Lay, Pearson Education Ltd., 3rd Edition, 2003.
- 4. Seymour Lipschutz: Probability:-**, Schaum's outline series, McGraw-Hill Pub., 2nd Ed, 2002.
- 5. Higher Engineering Mathematics:** - B.V. RAMANA, McGraw Hill Education, 2007

Course Articulation Matrix

Mapping of Course Outcomes (CO) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Sem: 4	Course code : P18MAES41	Title : Engineering Mathematics –IV											
CO's	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO-1	Solve algebraic, transcendental and ordinary differential equations arising in various engineering flow and design data problems, using numerical techniques along with physical interpretation of the solutions associated with initial/boundary conditions (UNIT-I)	2	2	-	-	-	-	-	-	-	-	-	-
CO-2	Learn logical thinking and analytical /geometrical skills in linear algebra through vector spaces, basis, dimension and linear transformations along with construction a matrix of linear transformations with respect change of Bases of same or different dimensions. Understand iterative methods in linear algebra such as Gauss-Jacobi, Gauss -Seidel, Relaxation and Power method and their practical utility in engineering fields(UNIT-II)	3	3	-	-	-	-	-	-	-	-	-	-
CO-3	Understand the basics of functions of complex variables, analytic functions, conformal and bilinear transformations, complex integration, line / surface / volume integrals and residue theorems with their scientific / engineering importance (UNIT-III)	3	3	-	-	-	-	-	-	-	-	-	-
CO-4	Apply the basic tools of statistics to understand curve fitting, moments, skewness, kurtosis, correlation and regression, for frequency distributions; explore the idea of probability, probability distributions, required in the analysis of engineering experiments (UNIT-IV)	2	2	-	-	-	-	-	-	-	-	-	-
CO-5	Apply the basic concepts of probability distributions to understand concept of joint probability and to find expectation covariance, correlation coefficient etc. and to understand probability vector, stochastic matrix etc. Obtain series solution of essential ODE's such as Bessel's and Legendre's differential equations and understand their scientific/engineering utility (UNIT-V)	3	3	-	-	-	-	-	-	-	-	-	-

Note: - Each unit contains two full questions of 20 marks each. Students are required to

Answer any **five** full questions choosing at least **one** full question from each unit.

Course Title : HYDROLOGY AND IRRIGATION ENGINEERING			
Course Code : P18CV42	Semester: IV	L - T - P : H : 3-0-0: 3	Credits :03
Contact Period: Lecture: 52 Hrs	Exam Hours :03 Hrs	Weight age: CIE:50; SEE:50	
Prerequisites : NIL			

Course learning Objectives (CLO)

1. To understand the concepts of hydrology , hydrology cycle and estimation of precipitation
2. To enable the knowledge of evaporation, infiltration, transpiration and runoff process.
3. To adopt design concept of canal, CD works and irrigation principles for water requirement of crops.
4. To enumerate the knowledge of Hydraulic structures, GWH, Stream flow, Hydrograph and earthen dams.

Course Content

UNIT – I

INTRODUCTION AND PRECIPITATION: Hydrology - Definition, importance, Hydrologic cycle-qualitative representation of hydrologic cycle, water resource in India and World. Precipitation-types and forms, Measurement of precipitation ,Standard gauge & float type of rain gauge. Mean precipitation over an area, estimation of missing rainfall data, rain gauge network, representation of rainfall data- rain fall mass curve & Hyetograph, consistency of rainfall data-Double mass curve technique. Problems.

Self Study Component: Meteorological Parameters.

10 Hrs

UNIT – II

ABSTRACTIONS AND RUNOFF: Evaporation : Definition, Factors affecting evaporation, Measurement of evaporation using evaporation pan (ISI standard pan), estimation of evaporation using empirical formula – Mayer’s and Rowher’s formula, problems.

Transpiration – Definition, Evapo-transpiration, Estimation of evapo-transpiration using Blaney-Criddle equation, problems. Infiltration – Infiltration capacity, Measurement of infiltration by infiltrometers, Infiltration indices. Problems. Runoff – Introduction, Types of runoff, Factors affecting runoff, Basin yield, Rainfall-runoff relationship, Khoslas method, problems.

Self Study Component: Reducing evaporation from water surface.

10 Hrs

UNIT – III

IRRIGATION AND WATER REQUIREMENT OF CROPS: Introduction, definition, necessity of Irrigation, Advantages and Disadvantages of irrigation, Types of Irrigation – surface and sub-surface, flow irrigation, lift irrigation, drip irrigation, sprinkler irrigation, Canals – Definition, Types, Design of stable channels- Kennedy’s theory and Lacey’s theory, Problems., Cross Drainage works-

types, selection of CD work, Aqueducts and super passages-types, soil moisture irrigation relationship, Frequency of Irrigation, Duty and Delta of a crop, Relationship between Duty and Delta, Factors affecting Duty, Problems.

Self Study Component: Water resource projects in Karnataka and India, maintenance of irrigation canals, efficiency of irrigation.

12 Hrs

UNIT-IV

HYDRAULIC STRUCTURES: Reservoirs, Gravity Dam and Spillways: Introduction , selection of site for a reservoir, zones of storage in reservoir, Storage capacity of a reservoir .Forces acting on Gravity dam, Elementary profile and practical profile of a gravity dam, modes of failures, Principal and shear stresses- simple problems, Two dimensional stability analysis by Analytical method, high and low gravity dam,. Spillway – Definition, types, Ogee spillway, Energy dissipaters.

Self Study Component: Galleries in dam, sedimentation in reservoirs.

10 Hrs

UNIT – V

STREAM FLOW, GWH, HYDROGRAPH, & EARTHEN DAMS: Stream–classification of stream, stage discharge relationship, measurement of velocity- cup type current meter. Measurement of discharge - area velocity method and slope area method – problems. GWH- Aquifers, Aquifer parameters, Well Hydraulics – Darcy’s law, steady-radial flow into a confined aquifer and unconfined aquifer-Problems, Hydrograph – Definition, components of a hydrograph, unit Hydrograph, unit hydrograph of different duration- problems. Earthen dams – Introduction, types, Causes of failure of earthen dams.

Self-Study Component: Separation of base flow, yield of an open well.

10 Hrs

TEXT BOOKS:

1. Engineering Hydrology – Subramanya K, Tata McGraw Hill, New-Delhi.
2. A Text Book of Hydrology – Jayarami Reddy, Lakshmi Publications, New-Delhi.
3. Irrigation engineering and hydraulic structure – S.K. GARG
4. Irrigation engineering and hydraulic structure– B.C. Punmia
5. Irrigation engineering and hydraulic structure–Ramamrutham

REFERENCES:

1. Hand Book of Hydrology – Ven Te Chow
2. Hydrology and Water Resources Engineering – R.K. Sharma and Sharma, Oxford and IBH, New Delhi.
3. Hydrology and water resources Engineering – Garg S.K., Khanna Publishers, New Delhi.
4. Ground Water Hydrology – Todd, Wiley eastern Publication, New Delhi.
5. Hydrology – H.M. Raghunath, Wiley Eastern Publication, New Delhi.
6. Irrigation engineering and hydraulic structure – P.M Modi and S.M. Seth
7. Irrigation and water power engineering –B.C.Punmia

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes (COs)

1. Apply the knowledge of science and mathematics to understand climatological parameters, runoff, stream flow and ground water flow.(PO1, PO2,PSO1)
2. Classify and to analyze problems related to crop water requirement, stream flow, hydrograph and ground water hydrology under different conditions. (PO1, PO2,PSO1)
3. To interpret data related to climatological parameter, stream flow reservoirs, ground water flow. (PO1,PO2,PSO1)
4. Apply the knowledge of hydrology and irrigation in future to design hydraulic structures either as an individual or as a team to satisfy the changing professional, environment and societal needs. (PO3, PO7, PO11, PO12,PSO2)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome												PSO				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
01	Apply the knowledge of science and mathematics to understand climatological parameters, runoff, stream flow and ground water flow.(PO1, PO2,PSO1)	2	2													2		
02	Classify and to analyze problems related to crop water requirement, stream flow, hydrograph and ground water hydrology under different conditions. (PO1, PO2,PSO1)	2	2													2		
03	To interpret data related to climatological parameter, stream flow reservoirs, ground water flow. (PO1,PO2,PSO1)	3	3													2		
04	Apply the knowledge of hydrology and irrigation in future to design hydraulic structures either as an individual or as a team to satisfy the changing professional, environment			3				3					3	3			2	

	and societal needs. (PO3, PO7, PO11, PO12, PSO2)																
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Course Title : Course Title : TRANSPORTATION ENGINEERING			
Course Code : P18CV43	Semester: IV	L - T - P : H : 3-0-0: 3	Credits :03
Contact Period: Lecture: 52 Hrs	Exam Hours :03 Hrs	Weight age: CIE:50; SEE:50	
Prerequisites :NIL			

Course Learning Objectives (CLOs)

This course aims to

1. Understand the knowledge of different modes of transportation and its importance
2. Understand the importance of Highway Geometric Design, Design control and its criteria.
3. Understand the importance of Railway Geometric Design, Design control and criteria.
4. Understand the importance of Airways Geometric Design, Design control and its criteria.
5. Understand the basic concept of tunneling.

Course Content

Unit-I

Principles of transportation engineering, highway development & planning: Importance of transportation. Different modes of transportation, characteristics and comparison of different modes, scope of highway engineering, classification of roads, , Highway alignment.

Design of highway pavements: Object of highway pavements, requirements of highway pavements, types of pavement structures and comparisons & their limitations, flexible/rigid pavements – components and their functions.

Self-study component: Highway projects, planning surveys and interpretations

12 Hrs

Unit-II

Geometric design of highways: Importance of geometric design, design control and criteria, highway cross section elements - cross slope or camber, medians, carriageway, kerbs, road margins, cross section details, right of way, sight distance, stopping sight distance (SSD), overtaking sight distance (OSD), design of horizontal alignment - design speed, horizontal curves, super elevation, widening of pavement on horizontal curves, transition curves. Gradient.

Self-study component: Vertical alignment –vertical curves, summit curves, valley curves. Problems on above.

10 Hrs

Unit-III

Highway materials and highway drainage: Materials used in highway construction, soil compaction, CBR test, stone aggregates, properties and tests, bituminous binders- types, functions and tests, bitumen emulsion, Portland cement and cement concrete. Bituminous paving mixes.

Highway drainage- objects of highway drainage, requirements and importance, surface drainage system and design, cross drainage structures, sub-surface drainage system, design of filter material, drainage of slopes and erosion controls,. Design problems.

Self-study component: road construction in water-logged areas

10 Hrs

Unit-IV

Railway engineering: Permanent Way, Requirements of an ideal permanent way, Gauges in Railway Track, Selection of Gauges, Railway Track Cross-sections, Coning of Wheels. Functions of Rails, Requirements, Types of Rail Sections, Comparison of Rail Types, Rail Failures, Rail Joints, Requirements, types of joints, Welding of Rails, Creep of Rails, Sleepers-function and requirements, Classification of Sleepers, Comparison of Different types of sleepers, Spacing of Sleepers and Sleeper Density

Self-study: Ballast- Functions and requirements, Types of Ballast.

10 Hrs

Unit-V

AIRPORT PLANNING AND RUNWAY DESIGN: Introduction to airport engineering, Regional planning and Airport site selection Runway Design - Orientation of runway by using wind rose diagram - Basic runway length, Corrections for Elevation, Temperature and Gradient to runway length by ICAO and FAA specification - runway cross sections problems on above.

Tunnels and harbors: Introduction – types of tunnels, advantages and disadvantages. Methods of tunneling in soft soil Liner Plate. Harbors-Introductions, classifications, natural phenomenon affecting the design of harbor viz. wind, wave, tide and currents. Harbor layout with component parts.

Self-study: Design of shape and size of tunnel

10 Hrs

TEXT BOOK:

1. Highway Engineering – S.K. Khanna, C.E.G Justo, and A.Veeraragavan, Nem Chand and Bros, Roorkee, Revised 10th Edition.
2. Highway Engineering- Kadiyali, L.R., Khanna Publishers, New Delhi.
3. Railway Engineering- Saxena and Arora, Dhanpat Rai and Sons, New Delhi.
4. Railway Engineering- Satish Chandra and Agarwal, M.M., Oxford University Press, New Delhi
5. Airport Planning and Design – Khanna, Arora and Jain – Nemchand Roorkee.
6. Dock & Tunnel Engineering- Srinivasan R Harbour, Charotar Publishing House.

REFERENCE BOOKS:

1. Relevant IRC codes
2. Principles of Transportation Engineering- Partha Chakra Borthy, Prentice- Hall.
3. Specifications for Roads and Bridges- MoRT & H, IRC, New Delhi

Note: Self-study is for 5 marks only in CIE and not in SEE

Course Outcomes (COs)

1. Apply the knowledge of science and engineering to acquire the fundamentals of different modes of transportation, engineering surveys and project preparation and study of different types of pavements. (PO1, PO12, PSO1)
2. Design of highway geometric elements in relation to safety and driver comfort (PO3, PO12, PO6, PSO2)
3. Identify different components of railway track and selection of appropriate materials for construction. (PO1, PO4, PSO3)
4. Plan and design of airport runway and to understand the components of harbor and tunnels and their classification. (PO3, PO1, PSO2)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of science and engineering to acquire the fundamentals of different modes of transportation, engineering surveys and project preparation and study of different types of pavements.	1											2	1		
02	Design of highway geometric elements in relation to safety and driver comfort			1			2						2		1	
03	Identify different components of railway track and selection of appropriate materials for construction.	1			2											3
04	Plan and design of airport runway and to understand the components of harbor and tunnels and their classification.	2		1											1	

Course Title : Course Title : Advanced Surveying			
Course Code : P18CV44	Semester: IV	L - T - P : H : 3-0-0: 3	Credits :03
Contact Period: Lecture: 52 Hrs	Exam Hours :03 Hr	Weight age: CIE:50; SEE:50	
Prerequisites :NIL			

Course Learning Objectives (CLOs)

This course aims to

1. Compute elevation and difference in elevation of objects and understand the working principle and operation of total station.
2. Construct simple curves, compound curves using Rankine's deflection angle and other methods.
3. Design and computation of reverse, transition curve and vertical curves.
4. Understand the concept of Global positioning systems and remote sensing.
5. Understand the concept of Geographic information system and astronomy.

Course Content

UNIT – I

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.

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

Self study component: Double plane method with two objects-two instrument stations.

12 Hrs

UNIT-II

Curve Setting-Simple curves: Curves - necessity, types, simple curves, elements of curves, designation of curves, setting out simple curves by linear methods, setting out curves by Rankine's deflection angle method.

Compound curve: Compound curves, elements of Compound curves, relationship between elements of compound curve for different cases. Design of compound curves, setting out of compound curves.

Self-study component: Setting out simple curve by two theodolite method.

10 Hrs

UNIT-III

Curve Setting -reverse, Transition, vertical curves: reverse curve between two parallel and non parallel straights (Equal radius and unequal radius), Numerical problems.

Transition curves characteristics, length of transition curve, setting out cubic parabola and Bernoulli's lemniscates Numerical problems

Vertical Curves: Types of vertical curves, length of vertical curves, computation and setting out of a vertical curve, sight distance. Numerical problems.

Self study component: Reasons to avoid reverse curves, Necessity and requirement of transition curve

10 Hrs

UNIT – IV

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.

Remote sensing: Introduction, components and working principle and area of application. Advantages and disadvantages, types of remote sensing, Different types of platforms, Electromagnetic radiation, Electromagnetic spectrum, atmospheric windows, spectral signature.

Self study component: Types of remote sensors.

10 Hrs

UNIT – V

Geographic information system: Introduction to Geographic information system, components and flow diagram of GIS, working/ functions of GIS, four M's, Advantages, applications of GIS. Data types of GIS.

Introduction to Astronomy: Earth, celestial sphere, earth and celestial coordinate systems, spherical triangle, astronomical triangle, Napier's rule, simple numerical problems.

Self study component: Time, Units of time, Inter conversion of time.

10 Hrs

Text Book:

1. Surveying, Vol 1,2 and 3 - B. C. Punmia , Laxmi Publications.
2. Plane Surveying, A. M. Chandra - New age international (P) Ltd.

Reference Books:

1. Surveying(Vol 1, 2& 3) – K.R Arora, Standard Book House, New Delhi
2. Higher Surveying A.M. Chandra New age international (P) Ltd.
3. Fundamentals of Surveying - Milton O. Schmidt - Wong, Thomson Learning.
4. Fundamentals of Surveying - S.K. Roy - Prentice Hall of India.

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of basic surveying to determine distance & elevation by trigonometric levelling.(PO1,PO12,PSO1)
2. Analyze different curves for roads and railways.(PO1,PO5,PO12,PSO2)
3. Interpret surveying data to design curves.(PO3,PO12,PSO3)
4. Understand the principles and techniques of modern surveying equipments and their applications.(PO4,PO12,PSO2)

Course Articulation Matrix (CAM)

Sl.No	Course Outcome-CO's	Program outcome												Program Specific outcome			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	
01	Apply the knowledge of basic surveying to determine distance & elevation by trigonometric leveling	3													1	2	
02	Analyze different curves for roads and railways	2				3									1		3
03	Interpret surveying data to design curves			2											2		2
04	Understand the principles and techniques of modern surveying equipments and their applications				2										1		3

Course Title : HYDRAULICS & HYDRAULIC MACHINES			
Course Code : P18CV45	Semester: IV	L - T - P : H : 3-0-0:3	Credits :03
Contact Period: Lecture: 52 Hrs	Exam Hours :03 Hr	Weight age: CIE:50; SEE:50	
Prerequisites : Knowledge of Mechanics of rigid and deformable fluids			

Course Learning Objectives (CLOs)

This course aims to

1. Differentiate open channel flow and pipe flow, classify open channels, compute the discharge in different types of channel sections and design most economical channel sections.
2. Find critical depth and critical velocity in open channels, know about hydraulic jump and its uses, and compute depth of hydraulic jump and loss of energy due to hydraulic jump in open channels.
3. Identify the number of variables in a phenomenon and establish relationship between the variables from the experimental data.
4. Find the impact of jet on various types of vanes; find the efficiency of the jet, work done by the jet on series of flat vanes and curved vanes which is the basis of the next units.
5. Characterize a hydro-electric power plant, classify the turbines and design the components of turbines and Predict and distinguish the performance of different turbines under different conditions and to know working of centrifugal pumps, its use in multistage pumps as per the requirement.

Course Content

Unit-I

Flow in Open Channels: Definition of open channels, classification, difference between pipe flow and open channel flow, types of flow, geometric properties of open channels. Uniform flow in open channels, Chezy's and Manning's formulae. Problems on uniform flow. Most economical sections of open channels. Derivation of conditions for most economical rectangular, triangular and trapezoidal channel sections. Problems. Specific energy, specific energy curve, condition for minimum specific energy and maximum discharge, Critical flow in rectangular channels, problems. Hydraulic jump in rectangular channels, derivations with Froude's number concept. Venturi flume, Problems on Hydraulic Jump.

Self-study component – Practical channel sections.

12 Hrs

Unit-II

Dimensional Analysis and Model analysis: Introduction to dimensional analysis, units and dimensions, table of dimensions. Dimensional homogeneity, methods of dimensional analysis - Raleigh's and Buckingham's method. Problems on Raleigh's and Buckingham's method. Model studies, introduction, comparison with dimensional analysis, similitude, dimensionless parameters. Types of models, Froude's model theory and problems, Reynold's model theory and problems.

Self-study component – Scale effect in models.

10 Hrs

Unit-III

Impact of Jet on Vanes: Introduction to impulse - momentum equation and its applications, Derivation of force exerted by a jet on a stationary target (vertical plates and curved plates only) Derivation of

force exerted by a jet on a moving target (vertical plates and curved plates only) Force exerted by the jet on a series of flat vanes and series of curved vanes. Equation for work done and efficiency, problems. Force exerted by the jet, work done and efficiency on a unsymmetrical curved moving vane-concept of velocity triangles, Force exerted by the jet on a series curved radial vanes mounted on a wheel. (Excluding inclined plates and hinged plates).

Self-study component – Force exerted and work done by the jet on inclined vanes. **10 Hrs**

Unit-IV

Hydraulic Turbines: Introduction, types and classifications of turbines, general layout of a hydroelectric power plant. Pelton wheel turbine - theory, equation for work done and efficiency, design parameters. Problems on Pelton wheel turbine. Francis turbine - theory, equation for work done and efficiency, design parameters, problems on Francis turbine, Kaplan turbine - theory, equation for work done and efficiency, design parameters, problems on Kaplan turbine.

Self-study component – Governing of turbines. **10 Hrs**

Unit-V

Performance of Hydraulic Turbines: Draft tubes- Types, equation for efficiency, problems, specific speed of a turbine, equation for the specific speed, problems, unit quantities of a turbine, definitions, equations and problems, characteristic curves of a turbine.

Centrifugal Pumps: Definition of pump, classification, description and general principle of working, priming methods, work done and efficiencies of a centrifugal pump, minimum starting speed, cavitation in centrifugal pumps, multistage centrifugal pumps, problems on centrifugal pumps.

Self-study component – Iso-efficiency curves. **10 Hrs**

Text Book:

1. Hydraulics and fluid mechanics, Modi and Seth Standard Book House, New Delhi.
2. Fluid mechanics and machinery, Raghunath. H M., CBS Publishers.
3. Text Book on fluid mechanics and hydraulic machines, Bansal R.K., Laxmi publications.

Reference Books:

1. Fluid mechanics and hydraulic machines, S.C. Gupta, Pearson Education, India.
2. Hydraulics and fluid mechanics, K.R. Arora, Standard Book house, New Delhi.
3. Hydraulic Machines, (6th edition) by Banga, T.R. and Sharma, S.C., Khanna Publishers.

Note : Self-study is for 5 marks only in CIE and not in SEE.

Course Outcomes (COs)

1. Apply the knowledge of basic science, mathematics and fundamentals of engineering to understand, classify, formulate and analyze problems related with open channel, hydraulic jump, impact of jet on vanes, pumps, turbines and to do dimensional analysis and model analysis.(PO1, PO2, PSO1)
2. Compute the discharge in different types channel sections, design most economical channel sections, analyze and interpret the data of various flow phenomenon to establish relationship among the variables in flow phenomenon, (PO3, PO4, PO11, PSO1, PSO2)
3. Select the models of various hydraulic structures, design the components of Turbines and Centrifugal pumps and evaluate the performance of Turbines and Centrifugal pumps under different conditions. (PO3, PO5, PSO2)
4. Apply the knowledge of open channel flow, hydraulic machines and model analysis in future to

Department of Civil Engineering

P.E.S College of Engineering, Mandya, (An Autonomous Institution under VTU)

work effectively either as an individual or as a team member to satisfy the changing professional and societal needs. (PO5, PO9, PO11, PSO1, PSO2, PSO3)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome												PSO					
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
01	Apply the knowledge of basic science, mathematics and fundamentals of engineering to understand, classify, formulate and analyze problems related with open channel, hydraulic jump, impact of jet on vanes, pumps, turbines and to do dimensional analysis and model analysis(PO1, PO2, PSO1)	3	2														3		
02	Compute the discharge in different types channel sections, design most economical channel sections, analyze and interpret the data of various flow phenomenon to establish relationship among the variables in flow phenomenon, (PO3, PO4, PO11, PSO1, PSO2)			3	2								2				2	3	
03	Select the models of various hydraulic structures, design the components of Turbines and Centrifugal pumps and evaluate the performance of Turbines and Centrifugal pumps under different conditions. (PO3, PO5, PSO2)			3		2												3	
04	Apply the knowledge of open channel flow, hydraulic machines and model analysis in future to work effectively either as an individual or as a team member to satisfy the changing professional and societal needs(PO5, PO9, PO11, PSO1, PSO2, PSO3)					3					2		1				1	2	2

Course Title : Course Title : BASIC STRUCTURAL ANALYSIS			
Course Code: P18CV46	Semester: IV	L - T - P : H : 2-2-0: 3	Credits :03
Contact Period: Lecture: 52 Hrs		Exam Hours :03 Hr	Weight age: CIE:50; SEE:50
Prerequisites :NIL			

Course learning Objectives (CLO)

1. To understand the different forms of structures and able to solve plane trusses by method of joints.
2. To understand the concepts of evaluation of deflection and slope in beams by various methods.
3. To gain the knowledge about the arches and cables and evaluate the forces in cables and arches.
4. To understand the concept of ILD, evaluation of continuous beams by clapeyron's method.

Course Content

Unit-I

Structural form, idealization, stability and determinacy: Skeletal or one, two, three dimensional structures, idealization of structures, Principle of superposition. Degree of static and kinematic indeterminacy in structures. Solve problems

Plane trusses: Introduction, assumptions, different types of trusses, methods of analysis of simple plane trusses - Method of joints Solve problems and introduction to methods of sections. (No numerical)
Deflection in beams – Introduction, differential equation of deflection curve, Macaulay's method for beam subjected to point loads and udl.

Self-Study Component: Numericals on methods of sections **12 Hrs**

Unit-II

Deflection: Conjugate beam method- Introduction, support conditions for the conjugate beams
Numerical on cantilever beams, simply supported beams
Moment area method -Introduction, equation for slope and deflection, Numerical on cantilever, simply supported beams

Self-Study Component: Deflection beams subjects to couple. **10 Hrs**

Unit-III

Cable structures: Introduction, analysis of cable subjected to concentrated loads, uniformly distributed vertical loads, length of cable, cable passing over pulley and saddle- Solved problems.
Three hinged arches: Circular and parabolic arches with supports at same levels and different levels, determination of thrust, shear and bending moment - Solved problems

Self-Study Component: Different types of arches with their key features **10 Hrs**

Unit-IV

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

Introduction to Energy Methods: Introduction, Castigliano's theorem, Betti's law and Maxwell's law, determination of deflection and slope of beams by Strain energy method

Self-Study Component: ILD for UDL greater than span. **10 Hrs**

Unit-V

Introduction to statically indeterminate structures: Introduction to indeterminate structures, Analysis of Propped cantilever beam by consistent deformation method

Analysis of statically indeterminate structures by three moment equation. (with static indeterminacy ≤ 3): Introduction - Analysis of continuous beam using Clapeyran's theorem of three moments, settlement of supports. Solved problems.

Self-Study Component: Introduction to fixed beams

10 Hrs

Text Book:

1. Theory of structures Vol 1– S.P.Gupta G.S. and R Gupta Pandit and, - Tata Mc-Graw Hill, New Delhi.
2. Basic structural analysis - Reddy C S – Second Edition, Tata Mc-Graw Hill, New Delhi.

Reference Books:

- 1.Strength of materials and theory of structures Vol 1 &Vol 2, Punmia B C, Jain R K, Laxmi publications, New Delhi.
2. Elementary structural analysis - Norris and Wilber, International student edition, Mc-Graw Hill Co. New York.
3. Classical structural analysis - A modern approach, Anthony. E.Armenakad, Mc-Graw Hill international edition, New York

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes (COs)

1. Identify, formulate and solve problems on frames, trusses, cables and arches.(PO1,PO12,PSO3)
2. Compute the deflections of determinate beams by Macaulay's method, moment area method and conjugate beam (PO1,PSO1,PSO3)
3. Interpret the influence line diagram to analyze beams under moving loads. (PO1,PSO1,PSO3)
4. Analyze statically indeterminate beams using strain energy, consistent deformation and theorem of three moments (PO3,PSO1)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Identify, formulate and solve problems on frames, trusses, cables and arches.	3											2			3
02	Compute the deflections of determinate beams by Macaulay's method, moment area method and conjugate beam	2												2		2
03	Interpret the influence line diagram to analyze beams under moving loads.	3												2		3
04	Analyze statically indeterminate beams using strain energy, consistent deformation and theorem of three moments			3										2		

Course Title : SURVEYING PRACTICE			
Course Code: P18CVL47	Semester: IV	L – T – P – H : 0– 0 – 3 – 3	Credits:1.5
Contact Period - Lecture: 39Hrs. Exam: 3Hrs.		Weightage: CIE: 50 %; SEE: 50%	

Course content

Exercise- 01: Introduction to surveying instruments (major and minor) ii) preparation of a chart of conventional symbols and tape.

Exercise- 02: Determination of the area for given points and distance measurement by radiation and intersection method respectively.

Exercise- 03: Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angle.

Exercise- 04: Determination of elevation of various points by plane of collimation method and rise & fall method.

Exercise- 05: L-Section and cross section of the road(with necessary drawing)

Exercise- 06: Conduct block leveling and draw Counter plan of given area (with necessary drawing)

Exercise- 07: To determine the elevation of the top of a tower/building using single plane method when base object accessible and inaccessible for different cases.

Exercise- 08 : To determine the difference in elevation and gradient between two points by tachometric survey.

Exercise -09: To determine the elevation of the top of a tower/building using double plane method and to find difference in elevation between two elevated objects.

Exercise -10: To set out simple curves using linear methods - perpendicular offsets from long chord and offsets from chords produced.

Exercise -11: To set out simple curves using Rankine's deflection angles method.

Exercise -12: Introduction to total station, components, and temporary adjustments. Measure Horizontal and vertical distance and area using Total Station

REFERENCE BOOKS:

1. Surveying, Vol.-1, Vol.-2, B.C. Punmia, Laxmi Publications, New Delhi.
2. Plane Surveying, Vol-1, Vol.-2, A.M. Chandra, Newage International © Ltd.
3. Plane Surveying, ALAK, S. Chand and Company Ltd., New Delhi.
4. Fundamentals of Surveying - S.K. Roy - Prentice Hall of India.
5. Surveying Vol. 1, Vol.-2, S.K. Duggal

Scheme of Examination:

Any one of the above exercise is to be conducted in the examination by the student along with viva and identification of instruments

Course outcomes

Students will be able to

1. Apply the techniques and skill of surveying and mathematics for linear and angular measurements for traverse survey.
2. Apply the techniques and skill of surveying for computation of levels and sketch L-Section, cross section and contour plans.
3. Apply the techniques and skill of surveying to compute Distance and Elevation using trigonometric and tachometric survey
4. Understand apply the knowledge of linear and angular method of setting out curves using theodolite.

Course Articulation Matrix(CAM)

Sl. No	Course Outcome – CO	Program outcome												PSO				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
01	Apply the techniques and skill of surveying and mathematics for linear and angular measurements for traverse survey	2	1													1		
02	Apply the techniques and skill of surveying for computation of levels and sketch L-Section, cross section and contour plans.	2	2														2	1
03	Apply the techniques and skill of surveying to compute Distance and Elevation using trigonometric and tachometric survey		2	2													3	
04	Understand apply the knowledge of linear and angular method of setting out curves using theodolite.		2	2			2											3

Course Title : HYDRAULICS & HYDRAULIC MACHINES LABORATORY			
Course Code : P18CVL48	Semester: IV	L - T - P : H : 0-0-3: 3	Credits :1.5
Contact Period: Lecture: 39 Hrs	Exam Hours :03 Hr	Weight age: CIE:50; SEE:50	
Prerequisites :NIL			

Course learning objectives (CLO)

1. To calibrate the coefficient of discharge using flow measuring devices and evaluate hydraulic coefficients.
2. To understand the concept of loss of energy in pipe flow due to various losses.
3. To determine the efficiency of different types of vanes and turbines.
4. Understand the performance of single stage and multistage pump.

Course Content

EXPERIMENTS:

Ex 1: Calibration of V-notch.

Ex 2: Calibration of rectangular or Trapezoidal notch.

Ex 3: Calibration of Ogee weir.

Ex 4: Calibration of Broad crested weir.

Ex 5: Calibration of Venturi flume.

Ex 6: Calibration of Venturi meter.

Ex 7: Determination of Darcy's friction factor for a straight pipe.

Ex 8: Determination of minor loss constants. (Bend, Elbow, Sudden contraction, sudden expansion)

Ex 9: Determination of vane coefficient for stationary flat and hemispherical vanes.

Ex 10: Determination of hydraulic coefficient of a vertical orifice.

Ex 11: Performance tests on a single stage and multi stage centrifugal pump (constant speed).

Ex 12: Performance tests on a Pelton wheel.

Ex 13: Performance tests on Francis or Kaplan turbine.

Self-study component: Identification of different types of jumps in open channels.

Text Books:

1. Hydraulics and fluid mechanics, Modi and Seth Standard Book House, New Delhi.
2. Fluid mechanics and machinery, Raghunath. H M., CBS Publishers.
3. Text Book on fluid mechanics and hydraulic machines, Bansal R.K., Laxmi publications.

Reference Books:

1. Fluid mechanics and hydraulic machines, S.C. Gupta, Pearson Education, India.
2. Hydraulics and fluid mechanics, K.R. Arora, Standard Book house, New Delhi.
3. Hydraulic Machines, (6th edition) by Banga, T.R. and Sharma, S.C., Khanna Publishers

Course Outcomes (COs)

1. Calibrate the flow measuring devices used in pipes, channels and tanks. (PO4,PSO2)
2. Evaluate and analyze various losses and loss coefficients in pipes. (PO4, PSO2)
3. Evaluate the efficiency of jets striking stationary flat and hemispherical vanes.(PO4, PSO2)
4. Evaluate the performance of turbines and pumps. (PO4, PSO2)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome - CO	Program outcome												Program Specific Outcomes				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
01	Calibrate flow measuring devices used in pipes, channels and tanks. (PO4,PSO2)				3												2	
02	Evaluate and analyze various losses and loss coefficients in pipes. (PO4, PSO2)				3												2	
03	Evaluate the efficiency of jets striking stationary flat and hemispherical vanes.(PO4, PSO2)				3												2	
04	Evaluate the performance of turbines and pumps.(PO4, PSO2)				3												2	

Course Title : Aptitude and Reasoning Development - Intermediate (ARDI)			
Course Code : P18HU49	Semester : IV	L - T - P : 2-0 - 0 - 2	Credits: 01
Contact Period: Lecture: 32 Hr. Exam: 3 Hr		Weightage: CIE:50%;SEE:50%	

Prerequisites: ARDB

Course Learning Objectives (CLOs)

This course aims to

1. Explain proportionality rule, average speed, relative speed and concepts in circular track.
2. Explain the application of time, speed distance in solving problems related to races, trains, boats and streams, and clocks.
3. Explain different methods to calculate number of smaller cubes, the date and the day of any year and the concepts of clocks.
4. Explain the methodology of strengthening or weakening the given statement.
5. Explain application of Venn diagrams in solving set theory problems.
6. Explains the concept of syllogism and provides the methodology to tackle the problems.
7. Describes all the important properties of triangle, polygons, circle and other geometrical figures and solve application based questions.
8. Describe the properties of cone, cylinder, sphere, cube and cuboid and solve the application based questions.
9. Differentiates between individual work and group work.
10. Integrates the concept of individual work in solving problems related to pipes and cisterns

Relevance of the course:

4th semester deals with more of quantitative aptitude. It is the intermediate level of aptitude which involves modules like Time speed distance. Time and work, set theory. This course also touches upon logical abilities through modules like cubes and Calendars.

Course Content

UNIT – I

Time, Speed and Distance:

Concept of motion and mathematical representation of motion, The rule of proportionality, Conversion between kmph to m/s, Concept of average speed and its application in different scenarios, Relative speed– Importance, application and observation in day to day life, same direction and opposite direction, An application of allegation in Time speed and distance, Trains– Different scenarios. Boats and streams– resultant speed, upstream and downstream concept. Circular motion– Two or three bodies meeting at the starting point or anywhere in the track. Races– Concept of head start, solving problems under different constraints. Application of solving problems under Clocks.

SSC: Basic relation between the 3 different quantities. Conversions between different UNITS of measurement. Speed and velocity. **6 Hrs**

UNIT – II

Cubes, Clocks & Calendars:

Cubes: Number of faces, vertices and edges. Colored cubes. Number of colored faces and the formulae to find-out the same. Problems on cubes.

Clocks & Calendars: Minute spaces. Hour hand and minute hand. Angle between the hands. Relative speed. Faulty clocks. Time gained or lost by the clock. Odd days. Leap year. Ordinary year. Counting of odd days. Problems on clocks and calendars.

Self-study Component- Knowledge about shapes and dimensions, Area and volume. Leap year, number of days. Important dates. **8 Hrs**

UNIT – III

Set theory and Venn diagram: Set builder form, Tabular form, Venn diagram, Types of sets, Operation of sets using venn diagram, Important properties, Algebraic laws of sets, Maxima and minima in set operation, Venn diagram for four sets.

Syllogism: Meaning of syllogisms, Format of problems and standard qualifiers, Concept of distribution, Standard question pattern, Application of venn diagram to solve problems. **Logical**

Venn diagrams: Analysis of the given problem and solve it.

Self-study Component- Basics about sets, operations using venn diagram. Basic applications.

6 Hrs

UNIT – IV

Geometry and Mensuration:

Theory, straight lines, triangles– theorems, area, lines inside triangle and geometric centre, Special property of an equilateral triangle, Application of Pythagoras theorem, Congruency and similarity of triangles, Basic proportionality theorem, Polygons, Quadrilaterals, Trapezium, Parallelogram, Rectangle, Rhombus, Square, Division of polygons, Circumscribed and Inscribed polygons, Concyclic points concept, Cyclic quadrilateral, Circle– Radius, Area and perimeter, Arc, Chord, Sector, Segment, Tangent, Secant, Area of common region Solid figures– Introduction, Classification of a solid, Net of a solid, Cuboid, Cube, Right cylinder, Pyramid– right pyramid, triangular pyramid, Cone– frustum of a cone, Sphere, Combination of solid.

Co-ordinate geometry:

Cartesian coordinate geometry– rectangular coordinate axis, distance formula, Section formula, Area of a triangle, Centre of gravity or Centroid of a triangle, In-centre of a triangle, Circumcentre of a triangle, Orthocentre of a triangle, Collinearity of three points, Slope of a line, Different forms of equations of a straight line, Perpendicularity and parallelism, Length of perpendicular.

Self-study Component-Basics of geometry, formula, dimensions, shapes. Different types of lines. Example – parallel, intersecting etc... **8 Hrs**

UNIT – V

Time and Work:

Relationship between time and work. Importance of efficiency, Conventional method of solving problems, L.C.M method, Negative work, The specific case of building a wall, Group work, Constant product rule, When work is not constant, Pipes and cistern– Similarity of logic.

SSC: LCM methods, basic arithmetic. Fractions and efficiency.

4 Hrs

Reference Books:

1. The Trachtenberg speed system of basic mathematics, published by Rupa publications.
2. CAT Mathematics by AbhijithGuha. published by PHI learning private limited.
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.
5. Quantitative aptitude for CAT by Arun Sharma, published by McGraw Hill publication.
6. Analytical reasoning by M.K Pandey BSC PUBLISHING.CO.PVT.LTD

Course Outcomes (CO)

After learning all the UNITs of the course, the student is able to:

1. Solve problems of higher difficulty level with ease in the following topics– Time, speed and distance and Geometry. L5
2. Analyze the number of colored faces in a cube when it is cut into different number of pieces and solve the problems under clocks and calendars. L5
3. Apply the concept of L.C.M in the module time and work to solve the problems with comprehension. L2
4. Analyze the concepts in Co-ordinate geometry by spatial visualization. L4
5. Interpret the logic in the statements of syllogism by critical thinking and apply venn diagram for the effective ways of deriving at the conclusion. L4
6. Determine the solutions for complicated problems of set theory using the concept of venn diagram. L4

Course Title : ADDITIONAL MATHEMATICS-II			
Course Code : P18MADIP41	Semester: IV	L - T - P : H : 0-0-3: 3	Credits :0
Contact Period: Lecture: 52 Hrs	Exam Hours :04 Hrs	Weight age: CIE:50; SEE:50	
Prerequisites :NIL			

(Mandatory Learning Course: **Common to All Branches**)
(A Bridge course for Diploma qualified students of IV Sem. B. E.)

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. **12 Hrs**

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. **06 Hrs**

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 42nd Ed. 2012.

References:

1. E. Kreyszig : Advanced Engineering Mathematics, John Wiley & Sons, 6th Ed., 2007
- 2.N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers,7th Ed., 2007.