Syllabus

Out Come Based Education

III & IV Semester
Bachelor Degree
in
CIVIL Engineering

2013-14

P.E.S. College of Engineering

Mandya - 571 401. Karnataka

(An Autonomous Institution Affiliated to VTU Belgaum)

Grant -in- Aid Institution

(Government of Karnataka)

Accredited by NBA, New Delhi

Approved by AICTE, New Delhi.

Ph : 08232- 220043

Fax : 08232 - 222075

Web : www.pescemandya.org

P.E.S. COLLEGE OF ENGINEERING, MANDYA
(An Autonomous Institution)
SCHEME OF TEACHING AND EXAMINATION
III Semester B.E. (Civil)

Sl No	Course Code	Course Title	Teaching Dept.	Hrs/ Week L:T:P:H	Credit	Examination Marks		
						CIE	SEE	Total Marks
1.	P13MAT31	Course I - Engineering Mathematics-III	Maths	4:0:0:4	4	50	50	100
2.	P13CV32	Building Materials & Construction	Civil	4:0:0:4	4	50	50	100
3.	P13CV33	Strength of Materials	Civil	4:0:0:4	4	50	50	100
4.	P13CV34	Surveying—1	Civil	4:0:0:4	4	50	50	100
5.	P13CV35	Fluid Mechanics	Civil	4:0:0:4	4	50	50	100
6.	P13CV36	Applied Engineering Geology	Civil	3:0:0:3	3	50	50	100
7.	P13CVL37	Survey Practice-1	Civil	0:0:3:3	1.5	50	50	100
8.	P13CVL38	Basic Material testing lab	Civil	0:0:3:3	1.5	50	50	100
9	P13HU39	Aptitude Competence and Professional Augmentation – I (ACPA- I)	HS&M	2:0:0:2	0	(50)	--	--
10	P13CVL310	Industry Interaction - I	Civil	0:0:1:1	0	(50)	--	--
11	P13HUDIP39	English & Persona Evolution[#]	HS&M	4:0:0:4	[2][#]	[50][#]	[50][#]	[100][#]
12	P13MADIP31	Additional Maths-I	Maths	2:0:0:2	0	(50)	---	---
13	P13HM311	Constitution of India & Professional Ethics	Human& Science	2:0:0:2	0	(50)	---	---
Total					26[28]	400[450]	400[450]	800[900]

L: Lecture, T: Tutorial, P: Practical, H: Hrs/ Week, CIE: Continuous internal evaluation, SEE semester end Examination, C: Credits. [##] ACPA- I All students shall have to pass this mandatory learning courses before completion of V - Semester.
[#]English & Persona Evolution Lateral entry students shall have to pass these Credit courses before completion of V- Semester.
*Additional Mathematics-I and Constitution of India & professional Ethics Lateral entry students shall have to pass these mandatory learning courses before completion of V- Semester.

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Measure the pressure in pipes	L1						-	-	-	-	-	-
Demonstrate Bernoulli's equations.	L2						-	-	-	-	-	-
Calibrate various notches and weirs.	L5						-	-	-	-	-	-
Study the performance of hydraulic machines.	L5						-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

P.E.S. COLLEGE OF ENGINEERING, MANDYA
(An Autonomous Institution)
SCHEME OF TEACHING AND EXAMINATION
IV Semester B.E. (CVIL)

Sl No.	Course Code	Course Title	Teaching Dept.	Hrs/ Week L:T:P:H	Credit	Examination Marks		
						CIE	SEE	Total Marks
1.	P13MAAC41+/ P13MAES41++	Course I - Engineering Mathematics-IV(HC)	Maths	4:0:0:4	4	50	50	100
2.	P13CV42	Concrete technology	Civil	3:0:0:3	3	50	50	100
3.	P13CV43	Analysis of structures –1	Civil	4:0:0:4	4	50	50	100
4.	P13CV44	Surveying –II	Civil	4:0:0:4	4	50	50	100
5.	P13CV45	Hydraulics & hydraulics machine	Civil	4:0:0:4	4	50	50	100
6.	P13CV46	Building planning & drawing	Civil	1:0:6:7	4	50	50	100
7.	P13CVL47	Surveying practice—II	Civil	0:0:3:3	1.5	50	50	100
8.	P13CVL48	Hydraulics & hydraulics machine lab	Civil	0:0:3:3	1.5	50	50	100
9	P13HU49	Aptitude Competence and Professional Augmentation – Ii (ACPA- II)	HS&M	2:0:0:2	0	(50)	--	--
10	P13xxL410	Mini Project- I	Civil	0:0:1:1	0	(50)	--	--
11	P13MADIP41	Additional Maths-II	Maths	2:0:0:2	0	(50)	--	--
12	P13EV49	Environmental Studies	Env	2:0:0:2	0	(50)	--	--
				Total	26	400	400	800

L: Lecture, T: Tutorial, P: Practical CIE: Continuous internal evaluation, SEE semester end Examination
*Additional Mathematics-II, Environmental studies & General Aptitude skills: Lateral entry students shall have to pass these mandatory learning courses before completion of VI- Semester.

Evaluation Scheme (For Theory Courses only)							
Scheme	**Weightage**	**Marks**	**Event Break Up**				
CIE	50%	50	**Test I**	**Test II**	**Quiz I**	**Quiz II**	**Assign-ment**
			35	35	5	5	10
SEE	50%	100	**Questions to Set: 10**		**Questions to Answer: 5**		

A. **Scheme of SEE Question Paper (100 Marks)**

Duration: 3Hrs	**Marks: 100**	**Weightage: 50%**

Each of the two questions set shall be so comprehensive as to cover the entire contents of the unit.
There will be direct choice between the two questions within each Unit
Total questions to be set are 10. All carry equal marks of 20
The no of subdivisions in each main question shall be limited to three only
No of questions to be answered by students is 5

Course Articulation Matrix (CAM)

Course Outcome (CO)		**Program Outcome** (ABET/NBA-(3a-k))											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
Measure the pressure in pipes	L 1						-	-	-	-	-	-
Demonstrate Bernoulli's equations.	L 2						-	-	-	-	-	-
Calibrate various notches and weirs.	L 5						-	-	-	-	-	-
Study the performance of hydraulic machines.	L 5						-	-	-	-	-	-

L- Low, M- Moderate, H-High

Ex 8: Determination of minor loss constants.
(Bend, Sudden contraction, sudden expansion)
Ex 9: Determination of vane coefficient for flat and hemispherical vanes.
Ex 10: Determination of hydraulic coefficient of a vertical orifice.
Ex 11: Performance tests on a single stage or multi stage centrifugal pump (constant speed).
Ex 12: Performance tests on a Pleton wheel.
Ex 13: Performance tests on Francis or Kaplan turbine.
Ex 14: Demonstration on working of Rain gauges.

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

Course Outcomes

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

1. Measure the pressure in pipes
2. Demonstrate Bernoulli's equations.
3. Calibrate various notches and weirs.
4. Study the performance of hydraulic machines.

Course Code : P13CV32	Semester : III	L - T - P : 4 - 0 - 0
Course Title : BUILDING MATERIALS & CONSTRUCTION		
Contact Period: Lecture: 52 Hr, Exam: 3 Hr	Weightage: CIE:50; SEE:50	
Prerequisites : Nil		

Course Learning Objectives (CLOs)

This course aims to

1. Define building stones, bricks, tiles, timbers, cement & Steel
2. 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

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.
. 10 Hrs

Unit-2

Foundation: **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, pile foundations (friction and load bearing piles), foundation in black cotton soil (or expansive soil) . 10 Hrs

Unit-3

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, 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.)
10Hrs

Unit – 4

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 and 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, paneled doors, , flush doors, collapsible and rolling shutters, Types of windows- paneled, glazed, bay window, dormer window, louvered and corner window, ventilators 12 Hrs

Unit 5:

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. 5 Hrs

Introduction to cost effective construction, miscellaneous topics: Necessity, advantages, prefabrication techniques, pre-cast doors and windows (pre-cast frames and shutters), alternative building materials, hollow concrete blocks, stabilized mud blocks, micro concrete tiles, pre-cast roofing elements.

Miscellaneous topics: Form work, form work details, RCC columns, beams floors, slip forming and damp proof construction. 5 Hrs

Text Book:

1. Building Construction by S.C. Rangwala, Charter Publishing House, Anand, India.
2. Building Construction by Sushil Kumar, Standard Publication and Distributors, New Delhi.

Reference Books:

1. Building Construction by Punmia B.C., Lakshmi Publications, New Delhi.
2. Advanced Building Materials and Construction by Mohan Rai and Jai Sing, CBRI Publications, Roorkee

Course Outcomes

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

1. Understand different types of construction materials.
2. Understand importance of preliminary investigation of soil, bearing capacity of soil, different types of foundations, pile foundation, well foundation and foundation in expansive soil
3. Classify Bonds in brick work, English bond, Flemish bond, Joints in stone masonry, arches.

Course Code : P13CV48	Semester : IV	L - T - P : 0 - 0 - 1.5

Course Title : HYDRAULICS AND HYDRAULIC MACHINE LAB

Contact Period: Lecture: 36 Hr, Exam: 3Hr	Weightage: CIE:50; SEE:50

Prerequisites : Nil

Course Learning Objectives (CLOs)

This course aims to

1. Predict discharge using V-notch.
2. Predict discharge using rectangular or Trapezoidal notch.
3. Predict discharge using Ogee weir.
4. Compute discharge using Broad crested weir.
5. Compute discharge using Venturi flume.
6. Compute discharge using Venturi meter.
7. Determine Darcy's friction factor for a straight pipe.
8. Determine minor loss constants.
9. Determine vane coefficient for flat and hemispherical vanes.
10. Determine hydraulic coefficient of a vertical orifice.
10. Conduct tests on a single stage or multi stage centrifugal pump (constant speed).
11. Conduct tests on a Pleton wheel.
12. Conduct tests on Francis or Kaplan turbine.
14. Demonstrate working of Rain gauges.

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.

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Prepare contour maps.	L 1	1					-	-	-	-	-	-
Apply corrections for traverse.	L 2	2 2					-	-	-	-	-	-
Measure horizontal and vertical angle and calculate horizontal distance and elevation of an object by trigonometric and tachometric survey.	L 5	2					-	-	-	-	-	-
Setting out of curves by linear and angular methods.	L 5	2					-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

4. Distinguish between Scaffolding, Shoring and underpinning, types of flooring etc. and method of construction.

5. Identify types of footing, RCC, raft and pile foundations in different soils.

Topic Learning Objectives

UNIT 1

Identify good quality of building stones.
Classify different types of bricks
Classify timber as per Indian standards and identify defects in timber.
Seasoning of timber.
Uses of ply wood.

UNIT 2

Define Preliminary investigation of soil
Understand Bearing capacity and safe bearing capacity of soil
Describe methods of determining bearing capacity and improving bearing capacity
Explain types of foundations - pile foundation and foundation in expansive soil.
Solve numerical examples.

UNIT 3

Define terms used in masonry.
Classify bonds in brick work, English bond and Flemish bond.
Reinforced brick masonary
Explain lintel, arches and chejja.
Distinguish between scaffolding, shoring, underpinning, types of flooring etc.

UNIT 4

Explain different types of roofs - flat, sloped- King post, Queen post.
Understand technical terms in stairs and its geometric design.
Distinguish between different types of stairs.
List types of doors and windows ventilator etc.

UNIT 5

Explain purpose of plastering, materials and methods of plastering.
Understand purpose of painting, types of paints and application of paints to new surfaces etc.
Understand polishing of wood surface .
Describe necessity and advantages of Pre-fabrication techniques, precast doors and windows, hollow concrete blocks etc.
Illustrate form work details of RCC beams, columns etc.

Review Questions
Unit-1

1.What are the classifications of timber as per Indian Standards? Explain defect and seasoning of timber
2. what are the classifications of bricks? Explain the test conducted on bricks?
3. What are the qualities of good building stones ?
4. What are the factors responsible for deterioration of stones ?
5. Explain the process of burning of bricks by Bull's trench with a sketch.
6. Explain the classification of bricks.
7. Briefly explain the defects due to insects in timber.
8. Explain the various methods of artificial seasoning.
9. Explain the process of slaking in the manufacture of fat line.
10. List the different types of cement and their uses.

Unit-2

1.Define safe bearing capacity of soil. Explain how do you carry out the preliminary investigation of the soil? Mention different methods and explain any one method.
2. Define safe bearing capacity of the soil.
3. Explain the essential requirements of a good foundation.
4. A brick, pier 300 mm x 300 mm is 3 m high. It has to carry an axial load of 500 kN. The safe bearing capacity of the soil is 250 kN/m^2. The unit weight of the brick masonry is 192 kN/m^3. The angle of repose is 30° and the bulk unit weight of the soil is 16 kN/m^3. Design a suitable foundation for the pier.
5. Explain the different types of foundation
6. Define safe bearing capacity and allowable bearing pressure of the soil.
7. Explain the methods of improving SBC of soil.
8. Determine the depth and width of a brickwall footing with the following data:

SBC of soil – 150 KN/m^2.

Load/m run of wall – 140 KN

Angle of internal friction of soil - 30˚

Thickness of wall – 300mm

9.What are the objectives of good foundation?
10. Define safe bearing capacity of soil. Explain how you determine the safe bearing capacity of soil by conducting plate load test.

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Prepare contour maps.	L 1	L					-	-	-	-	-	-
Apply corrections for traverse.	L 2	M					-	-	-	-	-	-
Measure horizontal and vertical angle and calculate horizontal distance and elevation of an object by trigonometric and tachometric survey.	L 5	M					-	-	-	-	-	-
Setting out of curves by linear and angular methods.	L 5	M					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Exercise - 5
To set out simple curves using linear methods - perpendicular offsets from long chord and offsets from chords produced.

Exercise - 6
To set out simple curves using Rankine's deflection angles method.

Exercise - 7
To set out compound curve with angular methods using theodolite only.

Exercise - 8
To set out the center line of a simple rectangular room using offset from base line.

Exercise - 9
Introduction to total station, components, temporary adjustments

Exercise -10
Use of hand held GPS for coordinate measurement.

Text Book:
1. .Surveying, Vol.-1, 2 and 3 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 - S.K. Roy - Prentice Hall of India.
3. Fundamentals of Surveying - Milton O. Schimidt - Wong, Thomson Learning.
4. Surveying Vol. I, S.K. Duggal, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.

Course Outcomes

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

1. Prepare contour maps.
2. Apply corrections for traverse.
3. Measure horizontal and vertical angle and calculate horizontal distance and elevation of an object by trigonometric and tachometric survey.
4. Setting out of curves by linear and angular methods.

Unit-3

1. Explain different types of stone masonry joints with neat sketches.
2. Differentiate between English bond and Flemish bond. Draw elevations of wall built in English and Flemish bond.
3. Explain the different types of stone masonry? And represent your answer through sketches
4. Explain the segmental arch with neat sketch.
5. Explain the classification of lintels based on construction of materials
6. Write a short note on:
i) Scaffolding ii) Under pinning iii) Shoring
7. Explain the material and methods of laying of,
i) Granolithic ii) Mosaic flooring.
8. Explain the different factors affecting the selection of a flooring material.
9. What are the different types of roof coverings commonly used for pitched roof?
10. Briefly explain the classification of lintels based on construction material

Unit-4

1 List the requirements of a good stair. Draw a neat sketch of spiral stair.
2. Draw a neat sketch of half glazed and half panelled door and label the parts.
3.What are the requirements of good stair?
4.Explain the different types of stairs.
5.Draw neat sketches (Elevation) of the following.
Half panelled and half glazed door.
Glazed window (Three shutter)
6.Design a suitable staircase in a room 4m x 5m. Height of each storey is 3.3m. Sketch the plan and elevation of the stair case designed. Assume all other data suitably.
7.Explain with neat sketches panelled doors.
8.Where do you provide Bay windows and Corner windows? Explain each with neat sketches.
9.What is meant by Horn? Why it is provided in doors and windows?
10 The inside dimension of the staircase in a residential building are 2 mx4.6 m. The height of floor is 3.30 m and the floor consist of RCC slab of 120 mm thickness. Design a proper layout of an RCC stair for this building. Assume the convenient height of riser 180mm.

Unit-5

1. Explain the purpose of plastering and explain any one method of plastering.
2. Explain the advantages and disadvantages of prefabricated construction
3. Explain the purpose of plastering. Write a note on stucco plastering
4. Explain the painting of wood surface and iron surfaces.
5. What are the characteristics of ideal paint?
6. Explain the different types of mortar used for plastering.
7. Explain the methods of plastering.
8. Write a note on pre-fabrication techniques.
9. Explain Damp proof course.
10. Write a note on pre-caste roofing elements.

Lesson Plan

Unit – I

Topics covered

1. Common building stones, Qualities of good building stones
2. Classifications of bricks, Manufacture of bricks
3. Manufacture of bricks.
4. Qualities of good bricks, Test on bricks, Types of tiles
5. Qualities of good tiles & its uses,
6.Classifications of timber as per Indian standards
7. Defects in timber
8. Seasoning of timber.
9. Natural &Artificial seasoning.
10. Ply wood and its uses.

Unit-2

Topics covered

1. Preliminary investigation of soil, bearing capacity of soil.
2. Safe bearing capacity of soil and methods of determining them.
3. Methods of improving bearing capacity
4. Classification of foundations, introduction to different types of foundations
5. Masonry footings -basic numerical problems
6. Isolated footings, combined footing .
7. RCC & Raft footing.
8. Pile foundations (friction and load bearing piles),
9.Foundation in black cotton soil (or expansive soil) 10.
10. Problems on different types of masonry footings

Course Code : P13CV47	Semester : IV	L - T - P : 0 - 0 - 1.5
Course Title : **SURVEYING PRACTICE – II**		
Contact Period: Lecture: 36 Hr, Exam: 3Hr		**Weightage: CIE:50; SEE:50**
Prerequisites : Surveying –II		

Course Learning Objectives (CLOs)

This course aims to

1. Conduct block leveling of a given area.
2. Operate theodolite and determine horizontal and vertical angles.
3. Operate theodolite to find elevation of a building.
4. Determine the tachometric constants.
5. Construct simple curves using linear methods.
6. Construct simple curves using Rankine's deflection angles method.
7. Construct compound curve with angular methods using theodolite.
8. Determine center line of a simple rectangular room using offset from base line.
9. **Use** total station.

10 Use of hand held GPS for coordinate measurement

Course Content

Exercise - 1

To conduct block leveling of an area and to draw contours by linear interpolation.

Exercise - 2

Measurement of horizontal angles with method of repetition and reiteration using theodolite, measurement of vertical angles using theodolite.

Exercise -3

To determine the elevation of the top of a tower/building using single plane method.

Exercise - 4

To determine the tachometric constants using horizontal and inclined line of sight. And find the distance and elevation of the object.

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Present fundamentals of graphics and drafting skills using computer aided drafting	L 1	2					-	-	-	-	-	-
Apply the knowledge to prepare engineering drawings using Auto cad.	L 2	1					-	-	-	-	-	-
Construct various civil engineering drawings- working drawing, site plan , key plan and soon	L 5	1					-	-	-	-	-	-
Acquire the skill to develop 3D civil engineering drawings using Auto Cad	L 5	2					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Unit-3

Topics covered

1. Definition of terms used in masonry, bonds in brickwork, English bond, Flemish bond.
2. Definition of terms joints in stone masonry, rubble masonry, coursed rubble masonry
3. rubble masonry, coursed rubble masonry
4. masonry arches
5. Classification, stability of an arch, lintels
6. Arch and lintel types and classifications and functions
7. Methods of construction of Chejja, canopy, balcony, shoring, underpinning, scaffolding
8. Types of flooring (materials and methods of laying)
9. Mosaic, marble, polished granite
10. Industrial flooring, flat roof (R.C.C.).

Unit-4

Topics covered

1. Sloped roof (R.C.C. and tile roof), lean to roof
2. Wooden truss (King post)
3. Wooden truss (Queen post)
4. Technical terms in stairs, requirements of a good stair
5. Geometric design of RCC dog legged
6. Geometric design of open well stairs
7. Plan and section of different types of doors, paneled doors
8. Plan and section of flush doors, collapsible and rolling shutters
9. Types of windows- paneled, bay window
10. Dormer window, corner window, ventilators

Unit-5

Topics covered

1. Purpose of Plastering, materials of plastering, lime mortar, cement mortar
2. Methods of plastering, stucco plastering, lath plastering
3. Purpose of painting, types of paints, application of paints to new surfaces
4. Distemper, plastic emulsion, enamel, and powder coated painting on walls and iron and steel surfaces

5. Polishing of wood surface
6. Necessity, advantages, Prefabrication techniques, pre-cast doors and windows (pre-cast frames and shutters)
7. Alternative building materials, hollow concrete blocks, stabilized mud blocks
8. Micro concrete tiles, pre-cast roofing elements
9. Form work, form work details, RCC columns, beams floors
slip forming, damp proof construction

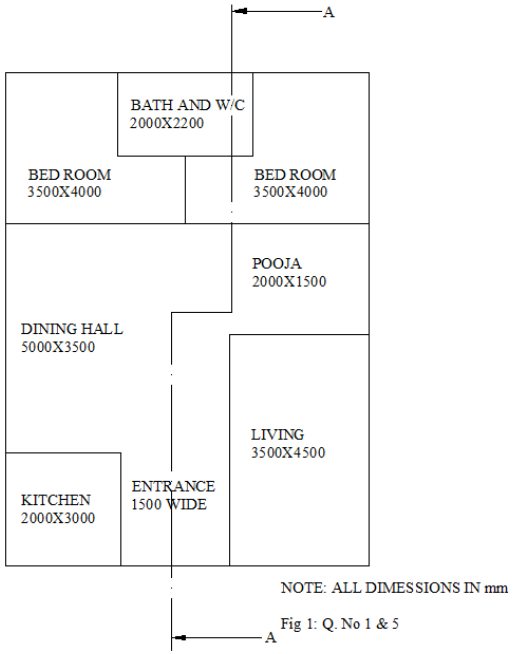
Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Present fundamentals of graphics and drafting skills using computer aided drafting	L 1	M					-	-	-	-	-	-
Apply the knowledge to prepare engineering drawings using Auto cad.	L 2	L					-	-	-	-	-	-
Construct various civil engineering drawings- working drawing, site plan , key plan and soon	L 5	L					-	-	-	-	-	-
Acquire the skill to develop 3D civil engineering drawings using Auto Cad	L 5	M					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Unit-5

For the fig shown in fig 1, show the water supplying and sanitary layout with suitable notations



NOTE: ALL DIMESSIONS IN mm

Fig 1: Q. No 1 & 5

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Understand different types of construction materials.	L 1	L					-	-	-	-	-	-
Understand importance of preliminary investigation of soil, bearing capacity of soil, different types of foundations, pile foundation, well foundation and foundation in expansive soil	L 2	M					-	-	-	-	-	-
Classify Bonds in brick work, English bond, Flemish bond, Joints in stone masonry, arches.	L 1	L					-	-	-	-	-	-
Distinguish between Scaffolding, Shoring and underpinning, types of flooring etc. and method of construction.	L 1	L					-	-	-	-	-	-
Identify types of footing, RCC, raft and pile foundations in different soils.	L 3	H					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Understand different types of construction materials.	L 1	1					-	-	-	-	-	-
Understand importance of preliminary investigation of soil, bearing capacity of soil, different types of foundations, pile foundation, well foundation and foundation in expansive soil	L 2	2					-	-	-	-	-	-
Classify Bonds in brick work, English bond, Flemish bond, Joints in stone masonry, arches.	L 1	1					-	-	-	-	-	-
Distinguish between Scaffolding, Shoring and underpinning, types of flooring etc. and method of construction.	L 1	1					-	-	-	-	-	-
Identify types of footing, RCC, raft and pile foundations in different soils.	L 3	3					-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

2. Draw to a scale of 1: 100, the following is views:
   Plan at sill level
   Front elevation
   Section – A-A
   Schedule of openings

Unit-2

1. a) Draw to a suitable scale the elevation of steel roof truss for a span of 15m.

b) Draw to a scale of 1:15 the plan and sectional elevation of an open well stair case for a public building located in a staircase hall measuring 4.5mX6.0m, height of roof=3.6m. adopt width of stair = 1.5m, riser=0.15m and thread= 0.3m.

Unit-3

1.Repair a bubble diagram (inter connectivity diagram) for a primary health centre a develop a single line diagram for a scale 1:100. Requirements are:
i) doctor's room
ii) nurse's room
iii) drug shop
iv) minor operation theatre
v) ten bed each for male and female wards.
Provide corridors, waiting lounge, toilets etc..

Unit-4

1. Prepare a single line diagram for a primary school building to a scale of 1:100. The details are given below:
i) 10 class rooms for a strength of 60 each
ii) Staff room
iii) Library
iv) Office room
v) Small conference hall
Show corridors and toilets.

Unit-4

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. 15 Hrs

Unit-5

For a given single line diagram, preparation of water supply, sanitary and electrical layouts. 9 Hrs

Text Book:

1. . Building Drawing: Shah M.H and Kale C.M, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
2 Building Construction, Guru Charan Singh, Standard Publishers & distributors, New Delhi.

Reference Books:

1National Building Code, BIS, New Delhi.
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Course Outcomes

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

1. Present fundamentals of graphics and drafting skills using computer aided drafting
2. Apply the knowledge to prepare engineering drawings using Auto cad.
3. Construct various civil engineering drawings- working drawing, site plan , key plan and soon
4. Acquire the skill to develop 3D civil engineering drawings using Auto Cad.

Review Questions

Unit-1

1. Single line diagram shown in fig 1 is of a residential building. The details are:

Plinth height = 0.5m
Roof height = 3.3m
Thickness of main wall = 0.3m
Thickness of RCC slab = 0.2m
Parapet = 1m above roof
Chejja = 0.6m and 0.1m thick
Thickness of partition walls = 0.2m
Width and depth of foundations for load bearing wall = 1m and for non load bearing wall = 0.9m.

Course Code : P13CV33	Semester : III	L - T - P : 4 - 0 - 0
Course Title : STRENGTH OF MATERIALS		
Contact Period: Lecture: 52 Hr, Exam:3 Hr	Weightage: CIE:50; SEE:50	
Prerequisites : Engineering Mechanics		

Course Learning Objectives (CLOs)

This course aims to

1. Understand the concept of deformable bodies and mechanical properties of engineering materials
2. Explain the concept of compound stresses, on inclined planes, general two dimensional stress system, principal planes and stresses and construct and interpret Mohr's circle for stresses for various cases of two dimensional stress systems.
3. Apply the concept of BM, SF and relation between loading, shear force and bending moment, BMD, SFD with salient values for cantilever beams, simply supported beams and overhanging beams subjected to gravity loads and their combinations and couple.
4. Determine the concept of simple bending theory, neutral axis, modulus of rupture, section modulus, flexural rigidity and stresses due to bending of beams of uniform section problems, distribution of shear stress in beam of rectangular, symmetrical I section, T section and circular section and problems
5. Analyse the concept of pure torsion and elastic stability of columns.

Course Content

Unit – I

Simple stress and strain: Introduction, simple stresses and strain, compressive, tensile and shearing stress, Hook's law, and Poisson's ratio, stress - strain diagram, ultimate strength, working stress, factor of safety and elastic constants and their relationships, volumetric strain, expressions and problems. Total elongation of tapering bars of varying circular and rectangular cross sections, elongation due to self weight and problems, state of simple shear stress and strain continued: Composite section, composite bars and columns, thermal stresses (including thermal stresses in compound bars) and problems 10 Hrs

Unit -2

Compound stresses: Introduction, stress components on inclined planes, general two dimensional stress system, principal planes and stresses at a point and problems, analysis of principal stresses and strain for various cases of two dimensional stress system. Mohr's circle of stresses and problems

Thick and thin cylinders: Introduction, thin cylinders under internal pressure, difference between thick and thin cylinders, Lame's theory, thick cylinders under internal pressure and external pressure.

10 Hrs

Unit-3

Bending moment and shear force in beams: Introduction, statically determinate beams, shearing force in beam, bending moment, and sign conventions. Relationship between loading, shear force and bending moment, shear force and bending moment equations. Shear force diagram and bending moment diagrams with salient values for cantilever beams, simply supported beams and overhanging beams subjected to gravity loads and their combtions and couple. 10 Hrs

Unit – 4

Bending stresses and shear stresses in beams : Introduction, bending stress in beam, simple bending theory, assumptions in simple bending theory, pure bending derivation of Bernoulli's equation, neutral axis, modulus of rupture, section modulus, flexural rigidity and stresses due to bending of beams of uniform section problems, distribution of shear stress in beam of rectangular, symmetrical, I section, T section and circular section and problems Introduction to Differential equation of deflection curve-Macaulay's method-simply supported beam with point loads. 12Hrs

Unit-5

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

Elastic stability of columns : Introduction - Short and long columns, Euler's theory on columns, effective length, slenderness ratio, radius of gyration and buckling load, assumptions, derivations of Euler's Buckling load for different end conditions, limitations of Euler's theory and problems. Rankine's formula and problems. 10 Hrs

Text Book:

1. Strength of Materials: 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: Basavarajaiah and Mahadevappa, Khanna Publishers, New Delhi.

Reference Books:

1. Strength of Materials: Singer Harper and Row Publications.
2. Elements of Strength of Materials: Timoshenko and Young Affiliated East -West Press.
3. Mechanics of Materials: James M. Gere (5th Edition), Thomson Learning.

Course Code : P13CV46	Semester : IV	L - T - P : 1 - 0 –3
Course Title : **BUILDING PLANNING AND DRAWING**		
Contact Period: Lecture: 84 Hr, Exam: 4Hr		Weightage: CIE:50; SEE:50
Prerequisites : Nil		

Course Learning Objectives (CLOs)

This course aims to

1. Write the plan and elevation of components of buildings.
2. Understand Functional design of building.
3. Develop plan, elevation, section and schedule of openings from the given line diagram of residential buildings i) Two bed room building ii) Two storeyed building.
4. Develop line diagram for i) Primary health centre, ii) Primary school building, iii) College canteen iv) Office building.
5. Prepare water supply, sanitary and electrical layouts for a residential building.

Course Content

Unit – I

To prepare working drawing of components of buildings i) Stepped wall footing and isolated RCC column footing ii) Fully paneled and flush doors iii) half paneled and half-glazed window iv) RCC dog legged and open well stairs v) Steel truss. 21 Hrs

Unit-2

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. 12 Hrs

Unit-3

Development of plan, elevation, section and schedule of openings from the given line diagram of residential buildings i) Two bed room building ii) Two storeyed building. 27 Hrs

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Differentiate open channel flow and pipe flow, classify open channels, classify open channel flow and compute the discharge in different types channel sections, design most economical channel sections.	L 1	2					-	-	-	-	-	-
Understand critical flow; compute critical depth, critical velocity, hydraulic jump and use of the gauging flumes in open channels.	L 2	1					-	-	-	-	-	-
Identify the number of variables in a phenomenon and establish relationship between the variables in a phenomenon	L 5	1					-	-	-	-	-	-
Classify the hydraulic machines and solve numerical problems on hydraulic machines.	L 5	2					-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

Course Outcomes

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

1. Understand the concept of deformable bodies and mechanical properties of engineering materials used by engineers during design and construction of civil engineering structures.
2. Apply the Knowledge of elasticity and evaluate the performance of deformable bodies under the action of different kinds of loads and composite sections and effect of temperature of various structural elements.
3. Explain the concept of compound stresses, on inclined planes, general two dimensional stress system, principal planes and stresses and construct and interpret Mohr's circle for stresses for various cases of two dimensional stress systems.
4. Distinguish between thick and thin cylinders subjected to internal & external pressure.
5. Understand the concept of pressure vessels; distinguish between thick & thin cylinders.

Topic Learning Objectives

UNIT 1

Understand types of stresses and strain.
Understand Hook's law, Poisson's ratio and elastic constants.
Apply the Knowledge of elasticity and evaluate the performance of deformable bodies under the action of different kinds of loads and composite sections and effect of temperature of various structural elements.
Numerical problems.

UNIT 2

Explain the concept of stress components on inclined planes.
Understand principal planes and stresses and Mohr's circle of stresses.
Distinguish between thick and thin cylinders subjected to internal and external pressure.
Analyze thin cylinders subjected to pressure, Lame's theory for thick cylinders.
Solve numerical problems.

UNIT 3

Understand statically determinate beams.
Distinguish between bending moment and shear force.
Explain relationship between loading, shear force and bending moment.
Understand shear force diagram and bending moment diagram.
Analyze statically determinate beams subjected to gravity loads and their combinations and couple.

UNIT4

Understand bending stress in beams and simple bending theory.
Understand assumptions in simple bending theory and Bernoulli's equation.
Define neutral axis, modulus of rupture, etc.,
Analyze distribution of shear stress in beams of different cross sections.
Analyze Differential equation of deflection curve-Macaulay's method.

UNIT 5

Analyse the concept of pure torsion, torsion equation of circular shafts, strength and stiffness, torsional rigidity and polar modulus for solid and hollow circular shafts, power transmitted by solid and hollow circular shaft
Differentiate between short and long columns.
Define effective length, slenderness ratio, radius of gyration and buckling load.
Explain Euler's Buckling load for different end conditions, limitations of Euler's theory and Rankine's formula.
Solve numerical problems.

Review Questions

Unit-1

1. State Hook's law and define Poisson's ratio.
2. Obtain expression for elongation of uniform bar due to self weight.
3. Obtain expression for volumetric strain of an elastic body and show that Poisson's ratio is less than or equal to 0.5
4. A circular rod of 60mm dia 250mm long subjected to an axial pull of 300kN. The increase in length was 0.15mm and decrease in dia was 0.012mm calculate the values of elastic constants and Poisson's ratio.
5. Establish relationship between modulus of Elasticity and Rigidity modulus from first principles.
6. A circular rod 250mm long and 60mm in diameter was subjected to an axial pull of 300 kN. The increase in length was 0.15mm and decrease in diameter was 0.012mm. Calculate Poisson's ratio and Elastic modulli.
7. Draw the stress strain diagram for Mild steel and explain in brief.
8. A bar of uniform thickness 't' tapers uniformly from a width of b_1 at one end to b_2 at other end in a length 'L'. Find the expression for the change in length of the bar when subjected to an axial force P.

.9. A concrete column of c/s area 400 mm x 400 mm is reinforced by four steel rods of 50 mm dia. Placed at each corner. If the column carries a compressive load of 300 kN.

1.

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Differentiate open channel flow and pipe flow, classify open channels, classify open channel flow and compute the discharge in different types channel sections, design most economical channel sections.	L 1	M					-	-	-	-	-	-
Understand critical flow; compute critical depth, critical velocity, hydraulic jump and use of the gauging flumes in open channels.	L 2	L					-	-	-	-	-	-
Identify the number of variables in a phenomenon and establish relationship between the variables in a phenomenon	L 5	L					-	-	-	-	-	-
Classify the hydraulic machines and solve numerical problems on hydraulic machines.	L 5	M					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Unit – III

1. Definition of impulse and momentum, Impulse-momentum equation and it applications, force exerted by the jet on stationary flat vertical, inclined and curved vanes.
2. Force exerted by the jet on stationary flat inclined and curved vanes.
3. Work done by the jet and efficiency of the jet on moving flat vertical, inclined and curved symmetrical vanes, when the jet strikes at the center.
4. Numerical examples on 2 & 3.
5. Work done by the jet and efficiency of the jet on moving curved vanes, when the jet strikes tangentially at one end (construction of velocity triangles and finding various components).
6. Numerical examples on 5.
7. Work done by the jet and efficiency of the jet on series of radial flat and series of radial curved vanes mounted on the periphery of a wheel and the jet striking at the center.
8. Numerical examples on 7
9. Work done by the jet and efficiency of the jet on series of radial curved vanes mounted on the periphery of a wheel and the jet striking tangentially at one.
10. Numerical examples on Francis turbine.

Unit – V

1. Variations in working conditions of hydraulic turbines. Definition of unit quantities- unit speed, unit power & unit discharge.
2. Derivation of equations for each unit quantity.
3. Definition of specific speed and derivation of equation for the same.
4. Numerical examples on 2&4.
5. Characteristic curves of hydraulic turbines. Definition of pump and centrifugal pump.
6. Components and working of centrifugal pump. Priming of centrifugal pump and methods.
7. Heads and efficiencies of a centrifugal pumps. Work done by the vanes on the liquid.
8. Numerical examples on 7.
9. Power required to drive centrifugal pump. Cavitation in centrifugal pumps.
10. Numerical examples on 9.

10. A flat bar of aluminum alloy 25 mm wide and 5 mm thick is placed between two steel bars each 25 mm wide and 10 mm thick to form a composite bar 25 mm x 25 mm and having same length 25 mm each. The three bars are fastened together at their ends when the temperature is 15°C. Find the stress in each of the materials when the temperature of the whole assembly is raised 55°C.

Determine;

Loads carried by concrete and steel

The compressive stress produced in the concrete and steel bars

Unit-2

1. What are principle stress and principle planes?
2. Derive lame's equation for hoop stress and radial stress in thick cylinders.
3. Direct stress of 120MPa tensile and 90MPa compression are applied to an elastic material at a certain point on the planes at right angles. The maximum principle stress is limited to 150MPa. What is the corresponding shear stress on the given planes and what will be the maximum shear stress at that point.
4. Two vertical rods one of steel and the other of copper are each rigidly fixed at top and are 500mm apart. Diameter and length of each rod are 20mm and 3.5m respectively. A cross bar is fixed at the lower ends of the rods.
5. Determine the location of a 5kN load to be placed on the cross bar so that it remains horizontal. Calculate the corresponding stresses in both rods. If the load is placed at the centre of cross bar, what will be the stresses in both the rods.
6. A compound bar is made of a central steel plate 50mm wide and 10mm thick to which copper plates 50mm wide 5mm thick are connected rigidly on each side. The length of compound bar at room temperature is 1000mm. If the temperature is raised by 100° C, determine the stress in each material and change in length of the compound bar. Take E_S = 200GPa, E_C = 100GPa, α_S = 12 X 10^{-6}/° C and α_C = 18 X 10^{-6}/° C.
7. Derive expressions for principal stresses and their planes in a general two dimensional stress system.

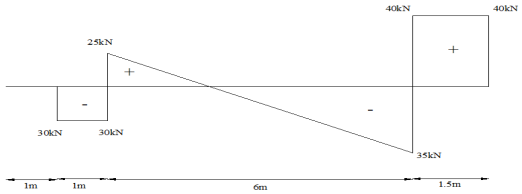
8. Intensity of stresses on planes AB and BC are shown in Fig Q3(b). Determine (i) Resultant stresses on plane BC. (ii) The principal stresses and their directions (iii) The maximum shear stresses and their planes.

9. Derive expressions for principal stresses and their planes in general two dimensional stress system.

10. Derive Lames's equation for radial and hoop stresses in thick cylinder.

Unit-3

1. Explain in brief sagging and hogging bending moment.
2. Obtain expression for maximum bending moment and shear force for a cantilever beam from first principle carrying UDL throughout span. Also sketch BMD and SFD.
3. SFD for a loading beam is shown in fig below. Obtain loading on the beam and hence sketch BMD. Locate the point of contra flexure if any.



4. Establish a relationship between bending moment, shear force and rate of loading for a loaded beam.

5. A simplify supported beam carries an UDL of intensity W/unit length over a span 'l'. Obtain maximum bending moment and shear force from the first principle.

6. A beam AB, 20m long supported on two intermediate props 12m apart carries a UDL of 10 kN/m together with concentraled loads of 32 kN at the left end 'A' and 60 kN at the right end 'B'. The props are so located that the reaction is the same at each support. Determine the position of the props and draw BM and SF diagrams. Locate point of contraflexure if any.

7. Derive the relationship between the shear force, bending moment and intensity of load

8. Draw the bending moment and shear force diagrams for the beam loaded as shown in fig. Find maximum BM and locate points of centraflexure

Lesson Plan

Unit – I

1. Definition of channel, canal and open channel, distinguish between open channel flow and pipe flow. Classification of open channels and geometric properties of open channels.
2. Derivation of Chezy's Equation, Formulae for finding the Chezy's constants.
3. Computation of discharge in open channels of rectangular and trapezoidal channel sections
4. Computation of discharge in open channels of triangular and circular channel sections.
5. Definition of most economical channel sections and derivation of conditions for most economical rectangular and trapezoidal channel sections.
6. Derivation of conditions for most economical Triangular and circular channel sections.
7. Numerical examples on Most economical channel sections.
8. Numerical examples on Most economical channel sections.
9. Definition of specific energy and specific energy curve, salient points in specific energy curve, definition of critical depth and critical velocity. Derivations for the same.
10. Numerical examples on critical depth, critical velocity, minimum specific energy. Definition of hydraulic jump in open channels and its uses.
11. Derivation of equation for sequent depth ratio, Derivation of energy loss due to hydraulic jump in terms of depth/velocity before jump and depth/velocity after the jump.
12. Numerical examples on hydraulic jump, loss of energy due to hydraulic jump. Use of gauging flumes in open channels (Venturi flume).

Unit – II

1. Introduction to dimensional analysis, uses of dimensional analysis, dimensions of different physical quantities.
2. Dimensional homogeneity, examples. Methods of dimensional analysis.
3. Explanation of Rayleigh Method, Examples.
4. Explanation of Buckingham's Π-theorem, procedure of Buckingham's Π -theorem for dimensional analysis.
5. Examples of Buckingham's Π-theorem for dimensional analysis. (2 hrs)
6. Introduction to model analysis, types of models and model similitude-types.
7. Dimensionless numbers – Reynold's number, Froude's number, Euler's number, Mach's number and Weber's number.
8. Model laws and numerical examples. (2hrs)

9. Francis turbine with an overall efficiency of 75% is required to produce 148.25kW power. It is working under a head of 7.62m. The peripheral velocity = $0.26(2gH)^{0.5}$ and the radial velocity of flow at inlet is $0.96(2gH)^{0.5}$. The wheel runs at 150rpm and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine the following:

i) The guide blade angles.
ii) The wheel vane angles at inlet
iii) Diameter of the wheel at inlet.
iv)Width of the wheel at inlet

10. Water enters a wheel consisting of curved vanes with an outside radius of 500mm and an inside radius of 25cm. The flow is inwards from the outer circumference. The supply jet is at 30^0 to the tangent to the outer circle with a velocity of 40 ms^{-1}. The water leaves the vane at 3.5 ms^{-1} at 120^0 to the tangent to the inner circle. Sketch the velocity triangles at inlet and outlet, also find the blade angle if the wheel runs at 360 Rpm.

Unit-5

1. Define specific speed of a turbine and derive the equation for the same.
2. Define unit speed and unit power. Derive the expressions for each of themBriefly explain the governing of impulse turbine.
3. With a neat sketch, explain the working of a centrifugal pump
4. What is priming? What are the methods of priming?
5. A centrifugal pump has an overall efficiency of 70% and supplies 25 lps of water to a height of 20m through a pipe of 100mm diameter and length 100m. Assume f = 0.012 and estimate the power required to drive the pump.
7. Define specific speed of a turbine and derive the equation for same
8. Define unit speed, unit discharge and unit power. Derive the expression for these terms.
9. A Francis turbine working under a head of 5 m at a speed of 210 rpm develops 75 kW, when the rate of flow of water is 1.8 m^3/s. The runner diameter is 1m. If the head on the turbine is increased to 16 m, determine its new speed, discharge and power.
10. What is priming? Why is it necessary? Mention any two priming devices

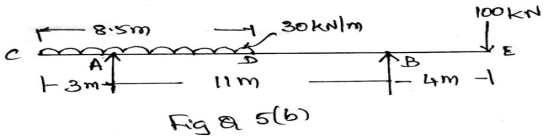


Fig Q 5(b)

9. Explain the terms (i) Saggging bending moment (ii) Hagging bending moment (iii) point of contraflexure
10. For the loaded beam shown in Fig Q5(b), draw BMD and SFD and locate point of inflexion if

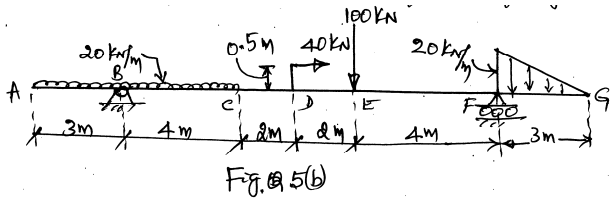


Fig.Q 5(b)

Unit-4

1. With usual notation derive pure bending equation.
2. An I-section having flanges 250mm wide and 24mm thick and web of 12mm thick with overall depth 600mm is used as simply supported beam. If this beam carries UDL of 50kN/m over span of 6m. Sketch variation of bending stress and shear stress across the section where maximum bending moment and shear force occurs in the beam.
3. Derive simple bending equation
4. A simply supported T-beam has a span of 2m. The flange is 125mm x 25mm and web is 175mm x 20mm. The beam carries UDL of 15kN/m throughout. Calculate bending stress and shear stress for maximum values of BM and SF. Draw variation of bending and shear stresses
5. A rectangular beam is to be cut out from a cylindrical log of diameter 'D'. Determine the dimensions of the beam so that it has greatest strength in bending. Also determine the ratio of width to the depth of the section.
6. A simply supported beam 100mm x 200mm carries a central concentrated load 'W'. The permissible stresses in bending and shear are $15N/mm^2$ and 1.2 N/mm^2 respectively. Determine the safe load W, if the span of the beam is 3m.

7. Draw the shear stress variation diagram across the depth for an unsymmetrical I-section having top flange 80x20 mm, bottom flange 160x20 mm and the web 20x200 mm.
8. State the assumptions made in simple bending theory.
9. Explain i) Pure bending ii) Neutral axis iii) Section modulus iv) Moment of resistance.
10. Show that maximum shear stress is 1.5 times average shear stress in a rectangular sections.

Unit-5

$$\frac{I}{I_p} = \frac{C\theta}{L} = \frac{f_s}{R}$$

1. Derive the torsion equation with usual notation.
2. Define effective length of column. State values of effective length for different end conditions of column.
3. Obtain Rankine's formula for failure of column.
4. Show that an hollow shaft is stronger and stiffer than a solid shaft for same material, length and weight.
5. Find the diameter of the shaft required to transmit 6000 Watts at 150 RPM, if the maximum torque is likely to exceed the mean torque by 25% for a maximum permissible shear stress of 60MPa. Find also twist for a length of 2.5m. Take C = 78.5 GPa
6. A hollow circular shaft of 6m length and inner and outer diameters of 75 mm and 100 mm is subjected to a torque of 10 kN-m. If C = 80 GPa determine the maximum shear stress produced and the total angle of twist.
7. Derive the expression for power transmitted by shaft.
8. A hollow shaft transmits 73.5KW at 120 RPM. Determine the required diameter, if the shear stress should not to exceed 80MPa and the twist should not to exceed 1/240 th of revolution in a length of 2.5m. Assume diameter ratio of 80% and take rigidity modulus C = 80GPa.
9. Derive an expression for a column with both ends hinged and modify the same for other end conditions using effective length concept.
10. A column 6 mtr long has both of its ends fixed and has a timber section of 150mm X 200mm. E= 17.5GPa, determine the crippling load on the timber column.

Lesson Plan

Unit – I

Topics covered

1.Introduction, simple stresses and strain, compressive, tensile and shearing stress

2

5. A jet of water with a velocity of 20m/s strikes a curved vane moving with 10m/s. The jet makes an angle of 20° with the direction of motion of vane at the inlet and leaves with an angle of 130° to the the direction of motion of vane at outlet. Calculate, i) The vane angles so that the water enters and leaves the vane without shock. ii) Work done / second / unit weight of liquid
6. State and explain Buckingham's π Theorem
7. What is similitude? Explain geometric similarity, kinematic similarity and dynamic similarity.

8. A model of spillway is made to test the flow. The discharge and the velocity of flow over the model were measured as 2-5 $m^3/5$ and 1.5m/s respectively. Find the discharge and the velocity over the prototype which is 50 times larger than its model.

9. A 1:5 scale model of a car is tested in a wind tunnel. The prototype velocity is 80 km/hr. If the model drag is 300 N, what is the drag and power required to overcome the drag in the prototype. The air in the model and prototype can be assumed to have the same properties

10. A 7m high, 15m long spillway discharges 100 cumecs of water under a head of 2m. If a 1:10 scale model of this spillway is to be constructed, determine the model dimensions head over the spillway model and the model discharge. If the prototype experiences a force of 750KW, determine the force on the model.

Unit-4

1. What is a turbine? How the turbines are classified?
2. Make a note on Surge tanks.
3. A Pelton wheel is to be designed for a head of 60m when running at 200rpm. The Pelton wheel develops 95.6475kW. The velocity of buckets is equal to 0.45 times the velocity of the jet, overall efficiency is 85%. 4.Determine the diameter of the jet, size of buckets and number of buckets.

5.Write a neat sketch of a Kalpan turbine, explain the parts and functioning of turbine. Write the equation involved to solve the problem
.6. Show that the maximum efficiency of a free jet striking a series of semi-circular vanes moving is 100%.
7. With a neat sketch explain the components of a hydel power plant.
8. .How the turbines are classified?

Unit-2

1.What is meant by dimensional homogeneity? Check, whether, $V= (2gh)^{0.5}$ is dimensionally homogeneous or not?
2. State and explain Buckingham's Π-theorem.
3. Assuming that rate of discharge 'Q' of centrifugal pump depends on mass density 'ρ', speed 'N', diameter of impeller 'D', pressure 'P' and viscosity of fluid 'μ', show that
4. Distinguish between i) Geometric similarity and kinematic similarity and ii) Distorted model Undistorted model.
5.Define Reynold's number, Froude's number and Euler's number.
6.A solid sphere of diameter 100mm moves in water at 5m/s,. It experiences a drag of magnitude 19.62N. What would be the velocity of 5m diameter sphere moving in air in order to ensure similarity? What will be the drag experienced by it?
7. Define specific energy. Establish a relation between the alternate depths for an horizontal rectangular open channel.
8. A horizontal rectangular channel 4m wide carries a discharge of 16 m^3s^{-1}. Determine whether a jump occurs at an initial depth of 50cm or not? If a jump occurs what is the sequent depth and energy lost due to the jump?
9.What is specific energy? With a neat sketch, explain a specific energy curve
10.Derive the equation for critical depth in a rectangular channel. Also show that Froude's Number is equal to one for critical flow.

Unit-3

1. Derive the equation for efficiency of a jet striking a series of flat vanes mounted on the periphery of a wheel and show that it will not exceed 50%.

2. Show that the force exerted by the jet on a stationary curved symmetrical vane is twice that on a stationary flat vertical vane.
3. A 7.5cm jet having a velocity of 30m/s strikes a flat vane, normal of which is inclined at 45 degrees to the axis of jet find the normal pressure on vane when, the vane is moving with a velocity of 15m/s away from the jet. Also determine the efficiency of jet.
4. Show that maximum efficiency of the jet striking a series of curved vanes moving in the direction at an angle θ and with a velocity u is $\eta_{max} = (1+\cos\theta)/2$.

2. Hook's law, and Poisson's ratio, stress - strain Diagram
3. Ultimate strength, working stress, factor of safety and elastic constants
4. Relationships between ultimate strength, working stress, factor of safety and elastic constants
5. Volumetric strain, expressions
6. Problems
7. Total elongation of tapering bars of Bars of varying circular and rectangular cross sections
8. Elongation due to self weight
9. Problems due to Elongation due to self weight
10. State of simple shear Stress and Strain continued
11. Composite section, composite bars and columns
thermal stresses (including thermal stresses in compound bars) and prolems

Unit – 2

Topics covered
1. Introduction, stress components on inclined planes
2. General two dimensional stress system
3. Principal planes and stresses at a point
4. Problems on principal planes and stresses at a point
5. Analysis of principal stresses and strain for various cases of two dimensional stress system
5. Mohr's circle of stresses and problems
6. Introduction, thin cylinders under internal pressure
7. Difference between thick and thin cylinders
8. Lame's theory, thick cylinders under internal pressure
9. Lame's theory, thick cylinders under external pressure

Unit – 3

Topics covered
1. Introduction, statically determinate beams, shearing force in beam
2. Introduction, statically determinate beams, bending moment, and sign conventions
3. Relationship between loading
shear force and bending moment, shear force and bending moment equations
4. Shear force diagram and bending moment diagrams with salient values for cantilever beams
5. Shear force diagram and bending moment diagrams with salient values for simply supported beams
6. Shear force diagram and bending moment diagrams with salient values for overhanging beams

7. Problems on Shear force diagram and bending moment diagrams with salient values for cantilever beams
8. Problems on Shear force diagram and bending moment diagrams with salient values for overhanging beams
9. Problems on different beams subjected to gravity loads and their combinations and couple

Unit – 4

Topics covered

1. Introduction, bending stress in beam
2. Simple bending theory, assumptions in simple bending theory
3. Pure bending derivation of Bernoulli's equation
4. Neutral axis, modulus of rupture, section modulus
5. Flexural rigidity and stresses due to bending of beams of uniform section problems
6. Problems continued
7. Problems on the distribution of shear stress in beam of rectangular section1
8. Problems on the distribution of shear stress in beam of rectangular symmetrical I sections
9. Problems on the distribution of shear stress in beam of rectangular symmetrical T sections
10 Problems on the distribution of shear stress in beam of rectangular symmetrical circular sections

Unit – 5

Topics covered

1. Introduction - pure torsion, torsion equation of circular shafts, strength and stiffness
2. Torsion rigidity and polar modulus for solid and hollow circular shafts
3. Power transmitted by solid circular shaft and problems.
4. Power transmitted by hollow circular shaft and problems
5. Introduction - Short and long columns, Euler's theory on columns
6. Effective length, slenderness ratio, radius of gyration and buckling load and assumptions
7. Derivations of Euler's Buckling load for different end conditions
8. Limitations of Euler's theory and problems
9. Rankin's formulae derivation
10. Problems on Rankin's formulae

UNIT 5

1. Predict the behavior of hydraulic turbines under different conditions.
2. Define unit quantities such as unit speed, unit power, unit discharge and deduce the relation for each of them.
3. Define the specific speed of a turbine and to derive the equation for the same.
4. Draw the characteristic curves of turbine under different conditions.
5. Define a pump and centrifugal pump, tell the functions of components of a centrifugal pump and working of a centrifugal pump.
6. Tell the necessity of priming of a centrifugal pump and the methods.
7. Define heads, losses and efficiencies of a centrifugal pump.
8. Find the work done by the vanes on the jet.
9. Find the power required to drive the centrifugal pump.
10. Effect of cavitation in centrifugal pumps.

Review Questions

Unit-1

1. Distinguish between pipe flow and open channel flow.
2. A channel of trapezoidal section has a bottom width of 5m and side slopes of 1 vertical to 2 horizontal. The bed of the channel drops 1m for every 600m length. If the discharge of the channel is 6.96 cumec, find the normal depth of flow and the mean velocity of flow in the channel. Take N=0.025.
3. What is a most economical channel section? Show that for a for most economical trapezoidal channel section, the wetted perimeter is three times the bottom width of channel.
4. Develop the standard chezy's equation for steady uniform flow in an open channel.
5. Show that half top width is equal to the length of sloping side for the most economical trapezoidal channel cross section
6. Derive the relationship between flow depth 'y' and radius 'r' in a circular open channel, for a. Maximum velocity b. Maximum discharge.
7. Define specific energy. Draw specific energy curve, and then derive the expressions for critical depth in a rectangular channel section
8. For a hydraulic jump in a rectangular channel the velocity and depth after the jump are known to be 0.8 m/s and 1.75m respectively. Calculate the depth before jump, the energy lost and power dissipated per meter width.
9. Derive the equation for loss of energy due to hydraulic jump in terms of velocity after jump and velocity before jump in rectangular channel section
10. Differentiate between pipe flow and open channel flow. Derive the chezy's equation for uniform flow through an open channel.
3.

5. Transfer the results of model tests to prototype with the help of model laws.
6. Distinguish a distorted model from undistorted model.

UNIT 3

1. Define impulse and momentum, state impulse momentum equation and apply in different fields.
2. Find the force exerted by the jet on stationary flat vertical and curved vanes.
3. Find the work done and the efficiency of jet on moving flat vertical plate and curved symmetrical plates, when the jet is striking at the center.
. Show that the force exerted by the jet on hemispherical vane is twice that on flat vertical vanes.
5. Construct velocity triangles necessary for computing velocity of whirl and vane angles.
6. Find the work done and efficiency of jet on curved vanes when the jet strikes tangentially at one end.
7. Find the work done and the efficiency of the jet on series of radial flat vanes and radial curved symmetrical vanes mounted on the periphery of a wheel when the jet is striking at the center.
8. Find the work done and the efficiency of the jet on series of radial curved vanes mounted on the periphery of a wheel when the jet is striking tangentially at one end.
9. Show that the efficiency of the jet on series of radial curved vanes is greater than that on series of radial flat vanes

UNIT 4

1. Define a hydraulic turbine, know the components of hydro-electric power plant.
2. Understand the importance of surge tanks in hydro-electric power plant and know different types of surge tanks.
3. Define gross head and net head of a turbine, define efficiencies of hydraulic turbines and to classify the turbines.
4. Distinguish an impulse turbine form reaction turbine, understand components and working of hydraulic turbines.
5. Find the efficiency of Pelton wheel turbine, Francis turbine and Kaplan turbine.
6. Design different components of Pelton wheel turbine, Francis turbine and Kaplan turbine.

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Understand the concept of deformable bodies and mechanical properties of engineering materials used by engineers during design and construction of civil engineering structures.	L 4	H					-	-	-	-	-	-
Apply the Knowledge of elasticity and evaluate the performance of deformable bodies under the action of different kinds of loads and composite sections and effect of temperature of various structural elements	L 4	H					-	-	-	-	-	-
Explain the concept of compound stresses, on inclined planes, general two dimensional stress system, principal planes and stresses and construct and interpret Mohr's circle for stresses for various cases of two dimensional stress systems.	L 3	H					-	-	-	-	-	-
Distinguish between thick and thin cylinders subjected to internal & external pressure.	L 3	H					-	-	-	-	-	-
Understand the concept of pressure vessels; distinguish between thick & thin cylinders.	L 3	H					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Understand the concept of deformable bodies and mechanical properties of engineering materials used by engineers during design and construction of civil engineering structures.	L 4	3					-	-	-	-	-	-
Apply the Knowledge of elasticity and evaluate the performance of deformable bodies under the action of different kinds of loads and composite sections and effect of temperature of various structural elements	L 4	3					-	-	-	-	-	-
Explain the concept of compound stresses, on inclined planes, general two dimensional stress system, principal planes and stresses and construct and interpret Mohr's circle for stresses for various cases of two dimensional stress systems.	L 3	3					-	-	-	-	-	-
Distinguish between thick and thin cylinders subjected to internal & external pressure.	L 3	3					-	-	-	-	-	-
Understand the concept of pressure vessels; distinguish between thick & thin cylinders.	L 3	3					-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

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

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

1. Differentiate open channel flow and pipe flow, classify open channels, classify open channel flow and compute the discharge in different types channel sections, design most economical channel sections.
2. Understand critical flow; compute critical depth, critical velocity, hydraulic jump and use of the gauging flumes in open channels.
3. Identify the number of variables in a phenomenon and establish relationship between the variables in a phenomenon.
4. Classify the hydraulic machines and solve numerical problems on hydraulic machines.

Topic Learning Objectives

UNIT 1

1. Define open channel, distinguish between open channel flow and pipe flow.
2. Classify the open channels and define the geometric properties of open channels.
3. Quantify the discharge in open channels of different sections using Chezy,s equation.
4. Define most economical channel sections and derive the conditions for most economical channel for rectangular, trapezoidal, triangular and circular channel sections.
5. Define specific energy, critical depth and critical velocity.
6. Find the value of minimum specific energy.
7. Define hydraulic jump in open channels and to understand the uses of it.
8. Derive the equation for sequent depth ratio and to quantify the energy loss due to hydraulic jump in terms of depth/velocity before jump and depth/velocity after the jump.
9. Know the use of Venturi flume in open channels.

UNIT 2

1. Write the dimensions of physical quantities; check the dimensional homogeneity of different known equations.
2. Identify dependent, independent variables and repeating variables.
3. Use different methods of dimensional analysis for establishing the relationship between dependent and independent variables.
4. Understand the types of similarities to be established between model and prototype.

Unit-2

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 models theory and problems, Reynold's models, theory and problems, scale effects. 10 Hrs

Unit-3

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) Concept of velocity triangles, Force exerted by the jet on a series of flat vanes and series of curved vanes. Equation for work done and efficiency, problems. (Excluding Inclined plates and hinged plates) 10 Hrs

Unit-4

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. 10Hrs

Unit-5

Performance of Hydraulic Turbines: Draft tubes: Types, equation for efficiency, problems, cavitations in turbines, 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, capitation in centrifugal pumps, multistage centrifugal pumps, problems on centrifugal pumps.

10Hrs

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.

Course Code : P13CV34	Semester : III	L - T - P : 4 - 0 - 0
Course Title : SURVEYING—1		
Contact Period: Lecture: 52 Hr, Exam:3 Hr		Weightage: CIE:50; SEE:50
Prerequisites : Nil		

Course Learning Objectives (CLOs)

This course aims to

1. Define surveying. Classify and identify basic principles of surveying.
2. Describe chain surveying and its operations.
3. Determine bearings and internal angles using compass.
4. Distinguish between types of leveling and to prepare data of leveling.
5. Understand characteristics of contours and methods of plain table surveying.

Course Content

Unit – I

Introduction :

Definition of surveying, classification of surveys, uses of surveying units of measurements, map and classification, survey of India topographical maps and their numbering, basic principles of surveying, errors, classification, precision and accuracy. **Measurement of horizontal distances:** Chain and types, tape and types, ranging of lines, direct and indirect, chain and tape corrections - numerical problems EDM devices. **10** Hrs

Unit-2

Chain surveying : 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, booking of chain survey work, field book, entries, conventional symbols, obstacles in chain survey, numerical problems, errors in chain survey and precautions to be taken.**Areas and volumes:** Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson’s one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes- trapezoidal and prismoidal formula, 10 Hrs

Unit-3

Measurement of Directions and Angles: 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 and numerical problems dip and declination.

Theodolite Survey : Theodolite and its types, fundamental axes and 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 **10** Hrs

Unit – 4

Introduction to Leveling : Principles and basic definitions, fundamental axes and relationship and part of a dumpy level, types of adjustments and objectives, temporary adjustments of a dumpy level, curvature and refraction correction, types of leveling, simple leveling, reciprocal leveling, profile leveling, cross sectioning, fly leveling.
Reduction of Leveling: Booking of levels, rise and fall method and height of instrument method, comparison, arithmetic checks, fly back leveling, errors and precautions. 10 Hrs

Unit-5

Contouring : Contours and their characteristics, methods of contouring, direct and indirect methods, interpolation techniques, uses of contours, numerical problems on determining inter visibility, grade contours and uses.
Plane Table Surveying : Plane table and accessories, advantages and limitations of plane table survey, orientation and methods of orientation, methods of plotting, radiation, intersection, traversing, resection method, solution to two point problem by graphical method, solution to three point problem, Bessel's graphical method, errors in plane table survey. **12** 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. Schimidt - 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

Course Code : P13CV45	Semester : IV	L - T - P : 4 - 0 - 0
Course Title : HYDRAULICS & HYDRAULIC MACHINES		
Contact Period: Lecture: 52 Hr, Exam: Hr		**Weightage: CIE:50; SEE:50**
Prerequisites : Fluid Mechanics		

Course Learning Objectives (CLOs)

This course aims to

1. Differentiate open channel flow and pipe flow, classify open channels, classifying open channel flow (laminar or turbulent, steady or unsteady, uniform or non-uniform, and critical, subcritical or supercritical), and compute the discharge in different types channel sections, design most economical channel sections.
2. Find critical depth and critical velocity in open channels, to tell the condition for critical flow, know about hydraulic jump and its uses, compute depth of hydraulic jump and loss of energy due to hydraulic jump in open channels. Use the gauging flumes 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. Find the 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, design the components of turbines.
6. Predict the performance of different turbines under different conditions
7. Distinguish a pump from a turbine, know working of centrifugal pumps, identify the losses to be considered for the design power required drive centrifugal pump, use 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.

12 Hrs

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Recognize theodolite, measurement of horizontal & vertical angles, and compute difference in elevation	L 1	2					-	-	-	-	-	-
Understand importance of different curves and set out of curves	L 2	2					-	-	-	-	-	-
Discuss the contours	L 5	2					-	-	-	-	-	-
Apply basic knowledge to handle advanced surveying instruments	L 5	2					-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

Course Outcomes

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

1. Define surveying, Classify & Indentify basic principles of surveying.
2. Compute the distance over sloping ground using chain and tape
3. Conduct compass traversing.
4. Apply the Knowledge of leveling & its importance in civil engineering.
5. Understand the concept of plane table surveying.

Topic Learning Objectives

UNIT 1

Use units of measurements in surveying.
Understand survey of India topographical maps and their numbering.
Identify errors in surveying.
Recognize chain, tape and its types.
Solve numerical problems.

UNIT 2

Use of optical square, prism square and cross staff.
Construct right angles and to prepare field book entries.
Predict errors in chain surveying.
Use trapezoidal and prismoidal formulae to find area and volumes.
Solve numerical problems.

UNIT 3

Understands meridians and bearings.
Use of prismatic compass and Surveyor's compass.
Differentiate magnetic bearing, true bearings, whole circle bearing and reduced bearing.
Name the parts of a transit theodolite.
Estimate horizontal angles and vertical angles by the method of repetitions and reiterations.

UNIT 4

Explain temporary adjustments and objectives of dumpy level.
Compute curvature and refraction correction.
Distinguish between simple leveling, reciprocal leveling and profile leveling.
Explain cross sectioning and fly leveling.
Describe Reduction of Leveling.

UNIT 5

Name and define methods of contouring.
Understand uses of contours.
Summarize advantages and limitations of plane table surveying.
Explain orientation and methods of orientation.
Determine traversing using two point and three point problems.

Review Questions
Unit-1

1. Explain the following
i) Classification of survey's
ii) Classification of errors
2. Explain the basic principle of surveying.
3. With neat sketch briefly explain direct and indirect methods of measuring distances on sloping ground.
4. Distinguish between
i) Plane survey and geodetic survey ii) Systematic errors and random errors
iii) Accuracy and precision. iv) Planimetric
5. Explain basic principles of surveying. survey and leveling.
6. What are the important features of topographical maps? How SOI topographical maps numbered?
7. Explain briefly the classification of surveys based on nature of field survey.
8. What are the different types or kinds of errors observed in surveying? Explain in detail.
9. List the objectives and uses of Surveying
10 Distinguish between
i) Accuracy and Precision
ii) Topographic survey and Cadastral Survey
iii) Cumulative error and compensating error

Unit-2

1. Sketch the map conventional sign for the following
i) Building
ii) Canal
iii) Bench mark
iv) River

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Recognize theodolite, measurement of horizontal & vertical angles, and compute difference in elevation	L 1	M					-	-	-	-	-	-
Understand importance of different curves and set out of curves	L 2	M					-	-	-	-	-	-
Discuss the contours	L 5	M					-	-	-	-	-	-
Apply basic knowledge to handle advanced surveying instruments	L 5	M					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Unit-3

1. Introduction to curves - necessity, types, simple curves
2. Elements of curves, designation of curves
3. Setting out simple curves by linear methods
4. Setting out curves by Rankine's deflection angle method.
5. Compound curves, elements of compound curves
6. Design of compound curves,
7. Numerical problems
8. Reverse curve between two parallel straights (Equal radius and unequal radius).
9. Introduction to transition curves and vertical curves
10. Parts of curves and their usage.
11. Numerical problems

Unit-4

1. Introduction to GPS and GIS
2. Global positioning systems, segments of GPS,
3. Working principle, Hand held GPS and differential GPS
4. Methods of GPS surveying
5. Errors and accuracy, applications of GPS.
6. Introduction to Geographic information system,
7. Components and flow diagram of working of GIS
8. Four M's its advantages
9. Introduction to remote sensing
10. Working principle and area of application.

Unit-5

1. Introduction to total station instrument, basic concepts
2. Measurement of distance using phase difference,
3. Total station components, adjustments, uses of total station
4. Errors, accuracy, effect of atmospheric conditions.
5. Basic concepts of terrestrial photogrammetry
6. Basic concepts of aerial photogrammetry
7. Photo theodolite
8. Horizontal and vertical angles,
9. Horizontal position, types of photographs
10. Geometry of aerial photographs.

2. In passing an obstacles in the form of a font stations A and D on the main line were taken on the opposite side of the pond, on the left of AD, a line AB 200m long was laid down and second line AC 300m long was range on the right of AD, the points B, D and C being on the same straight line BD and DC were then chained and found to be 125m and 150m respectively. Find the length of AD
3. Distinguish between direct and indirect ranging.
4. With a neat sketch explain the meaning of hypotenusal allowance. Find the hypotenusal allowance per chain of 20m if i) angle of slope is 10° ii) the ground rises by 4m in one chain length.
5. A 30m tape weighs 0.12N/m has a cross sectional area of 0.020cm^2. It measures correctly when supported throughout under a tension of 85N and at a temperature of 20°C. When used in the field, the tape is only supported at its ends, under a tension of 85N. Tthe temperature is 13.5^{0}C. What is the distance of zero and 30m mark under these conditions?
6. What is 'Hypotenural allowance'? Explain.
7. The plan of an old survey map plotted to a scale of 1cm = 10 m had a note that the 30 m chain used was 0.7 links too short. It was also found that the plan had shrunk so that a line originally 10 cm long was 9.65 cm. The area of the plot on the plan was found to be 62.5 cm^2. What is the correct area of the plan in hectares?
8. Define Ranging of a line. Discuss Reciprocal ranging.
9. Explain any one method of measuring distances on sloping ground.
10. A steel tape of 100 m length is suspended between the ends under a pull of 200 N. The weight of the tape is 30 N. Find the correct horizontal distance between the ends of the tape.

Unit-3

1. Distinguish between

i) True bearing and magnetic bearing.
ii) Whole circle bearing and quadrantal bearing
iii) Dip and declination

2. The following fore bearings and back bearings were observed with a compass. Calculate the interior angles.

LINE	FORE BEARING	BACK BEARING
PQ	S 37°30′ E	N 37°30′ W
QR	S 43°15′ W	N 44°15′ E
RS	N 73°00′ W	S 72°15′ E
ST	N 12°45′ E	S 13°15′ W
TP	N 60°00′ E	S 59°00′ W

3. The fore bearings and back bearings of the lines of a closed compass traverse are as follows

LINE	FORE BEARING	BACK BEARING
AB	32°30′	214°30′
BC	124°30′	303°15′
CD	181°00′	1°00′
DA	289°30′	108°45′

Correct the bearings for local attraction and determine the true bearings if the declination at the place is 3° 30′ W

4. What is a 'well conditioned triangle'? Explain.

5. Briefly explain the conditions to be fulfilled by survey lines or survey stations

6. Two points P and Q are situated at a distance of 180 m on the nearer bank of a river flowing from west to east. The bearings of tree on the opposite bank of the river are taken from the points P and Q, they are 22^o and 312^o respectively. Determine the width of the river.

7. Explain the difference between:
i) Fore bearing and back bearing ii) Dip and declination.

8. In an old map a line AB was drawn to a magnetic bearing of $5^o30'$, the magnetic declination at the time being 1^o East. To what magnetic bearing should the line be set now if the present magnetic declination is $8^o30'$ East.

9. The following bearings were observed in a closed compass traverse. Determine the interior angles of the traverse and apply necessary check. Draw a neat sketch of the traverse

10.A tower, lying on a flat area having an average elevation of 800 m above mean sea-level, was photographed with a camera having a focal length of 24 cm. The distance between the images of top and bottom of the tower measures 0.34 cm on the photograph. A line AB, 200 m long on the ground, measures 12.2 cm on the same photograph. Determine the height of the tower is the distance of the image of top of the tower is 8.92 cm from the principal point.

Lesson Plan

Unit-1

1. Introduction, adjustment of traverse**, c**oncept of latitude and departure
2. Concept of latitude and departure and its application
3. Traverse-closed and open traverse
4. Computation of bearings of legs of closed traverse given the bearing of one of the legs
5. Computation of included angles given the bearings of legs of a closed traverse
6. Checks of closed traverse and determination of closing error and its direction
7. Bowditch's graphical method of adjustment of closed traverse
8. Bowditch's rule and transit rule
9. Omitted measurements (only length and corresponding bearing of one line).
10. Local attraction, error determination and corrections.

Unit-2

1. Introduction to trigonometric leveling
2. Determination of elevation of objects when the base is accessible and inaccessible by single plane method
3. Determination of elevation of objects when the base is accessible and inaccessible double plane method
4. Distance and difference in elevation between two inaccessible objects by double plane method.
5. Numerical problems.
6. Introduction to tacheometric surveying, **b**asic principle
7. Types of tachometric survey
8. Numerical problems on horizontal and inclined line of sight.(no derivation)
9. Applications analectic lens in external focusing telescopes
10. Reducing the constants in internal focusing telescope.

Unit-4

1.What are the methods of GPS surveying? Explain errors and applications of GPS.

2. write the components and flow diagram of working of GIS.

3. Write short note on remote sensing.

4.Explain the applications of remote sensing.

5. Explain with the help of a neat sketch, an idealized remote sensing system

6.Explain the interaction mechanism of EM radiation with earth's surface, starting the basic interaction equation

7. Explain the various types of structures used in GIS.

8. Write a note on linkage of GIS to remote sensing.

9. Write a note on application areas of GIS & remote sensing.

10. What do you understand by electromagnetic spectrum ? State the wavelength regions, along with their uses, for remote sensing applications.

Unit-5

1.What are the advantages of total station over conventional instrument.

2. Write a short note on

i) terrestrial photogrammetry

ii) aerial photogrammetry

3. Measurement of distance using phase difference.

4. Explain the following applications in total stations :

i) REM

ii) RED

Iii) Location of building, bridges, chimneys etc

5. Explain the location of a boundary ,plotting contours.

6. Explain the calculations of volume & development of 3D ground features.

7. Describe the various steps involved in the combination of vertical air photographs by the principle point radial line method

8. An object has an elevation of 400 m above mean sea-level. When the photograph was taken to the image of that point on the photograph is 4.86 cm. If the datum scale is 1/12000 and focal length of the camera is 24 cm, determine the relief displacement of the point.

9. A tower AB is 40 m high, and the elevation of its bottom B is 800 m above mean sea-level. The distance of the image of the tower on a vertical photograph, taken at a flight altitude of 1800 m above mean sea-level, is 8.42 cm. Compute the displacement of the image of the top of the tower with respect to the image of its bottom.

Line	F.B
AB	N 60°30′ E
BC	S 58° E
CD	N 46° E
DE	S 25°30′ W
ED	N 60° W

10. A chain ABC crosses a river at right angles. B and C are two points located at the near and far banks respectively. AB = 50 m, BD = 100 m and angle ABD = 90º. The whole circle bearing of C and A taken at D are 60º and 150º respectively. Find the width of the river.

Unit-4

1.Explain the following

i) Different types of bench mark

ii) Temporary adjustments of dumpy level

iii) Profile levelling and cross sectioning

2. The following staff reading were observed successfully with level the instrument having been moved forward after the second fourth and eighth readings.

0.875, 1.235, 2.310, 1.385, 2.930, 3.125, 3.955, 0.120, 1.875, 2.030, 3.765

The first reading was taken with the staff held on bench mark of elevation 132.135m. find the RL of points using HI method, apply the usual checks.

3.Draw a neat sketch showing fundamental axes of a dumpy level. State the relationships between them.

4.Briefly discuss the temporary adjustments of a dumpy level.

5. Discuss briefly the effects of curvature and refraction in leveling. Find the combined correction for curvature and refraction for a distance of 3 km.

6.The following readings are successively taken from an instrument in a leveling work: 0.255, 0.385, 0.520, 1.785, 1.895, 2.300, 1.785, 0.335, 0.858, 1.255. The position of instrument was changed after taking third and sixth readings. Draw a level field book and enter the readings. Assume the RL of first point as 80.000m. Calculate the RL of points by rise and fall method. Apply arithmetic checks.

7. Explain the merits and demerits of booking and reduction of levels using height of instrument method and rise and fall method.

8. List the different types of leveling? Briefly explain profile leveling.

9.Write a short note on correction for curvature and refraction

10.During the construction of a building the following reading were taken with a leveling staff of 4m and dumpy level. Enter the readings in a level page and calculate the RL of ceiling and apply the usual checks

Point	Staff reading	Remarks
A-Underside of chajja	2.14 m	BM. RL = 202.40m staff inverted
B- Peg on ground	1.040	Change point
B- Peg on ground	1.240	
C- underside of ceiling	3.835	Staff inverted

Unit-5

1.Write short notes on .
i) characteristics of contours
ii) interpolation of contours
iii) methods of orientation of plane table
iv) errors in plane table survey

2. List out the characteristics of contours.

3. What is meant by interpolation of contours explain any two methods of interpolation.

4. What are the factors influencing the selection of contour interval

5. What is meant by orientation of plane table? Explain the different methods of orientation of plane table.

6. List out the accessing used in plane table and briefly explain their importance.

7. What are the different methods of plane table survey? Briefly explain Bessel's three point problem with neat sketch.

8. What are the advantages and disadvantages of plane table survey?

9. What is orientation of plane table? Explain any two methods of achieving orientation

10. Write short notes on
i) Characteristics of contours. ii) Uses of contours

Instrument Station	Staff Readings on BM	Vertical angle to top of target	R.L of BM
O_2	2.550	$18^\circ\ 6^1$	345.580
O_1	1.670	$28^\circ\ 42^1$	345.580

5. Explain single plane method to determine the horizontal distance b/w instrument station and object and elevation of the object. Discuss for elevated and depressed line of sight.

6. Find the elevation of the top of a chimney from the following data

Inst. Station	Reading on BM	Angle of elevation	Remarks
A	0.862 m	$18^o\ 36'$	RL of BM = 421. 380
B	1.222 m	$10^o 12'$	Distance AB = 50 m

7. Explain single plane method for determining the RL of an elevated object with base inaccessible.

8.Find the elevation of the top of a chimney from the following data

Inst. station	Reading on BM Angle of elevation	Remarks
A	0.862 m 18° 36'	RL of BM = 421.380 m
B	1.22 m 10° 12'	Distance AB = 50 m

9. Explain very different level case in trigonometric levelling and derive the equation for elevation of the given object.

10.Explain double plane method in tacheometric levelling and derive the equations for distance and elevation

8.What is closing error in closed compass survey? Explain how it is adjusted using Bowditch's rule and transit rule.

9. Following table gives lengths and bearings of four line of a closed traverse ABCDEA ,Determine the length and bearing of the line EA

Line	length	bearing
AB	----------194.1m----------	85°30[1]
BC	----------201.2 m----------	15°00[1]
CD	---------- 165.4 m----------	285°30[1]
DE	---------- 172.6 m----------	195° 30[1]

10. The following bearings were observed in running a closed traverse

Line	F.B	Bearing
AB	75^0 5'	254º20'
BC	115^0 20'	$296^0$35'
CD	165^0 35'	$296^0$35'
DE	224^0 50'	44º5'
EA	304^0 50'	125º5'

At what stations do you suspect the local attraction ? Determine the correct magnetic bearings. If declination was 5^0 10' E, what are the two braeings ?

Unit-3

1Derive the equation for setting simple curve by;
i) Ordinates from long cord
ii) Offset from tangent
2.Two parallel railway lines are to be connecter by a reverse curve, each section having the same radius. If the lines are 12m apart and the maximum distance between tangent points measured parallel to the straights is 48m, find the maximum allowable radius. If however, both the radii are to be different calculate the radius of the second branch if that of the first branch is 60m. Also calculate the length of both branches.
3.With the help of a neat sketch explain the method of determining the reduced level of an inaccessible point, when the instrument stations and the object are not in same vertical plane.
4.The following observations were made on a hilltop to ascertain its elevation. The height of the target (F) was 5m. the instrument stations O_1 & O_2 were 100m apart and were inline with F. compute the RL of the top of the hill.

Lesson Plan

Unit – I

Topics covered

1. Definition of surveying, classification of surveys.
2. Uses of surveying units of measurements
map and classification, survey of India topographical maps and their numbering
3. Basic principles of surveying, errors
4. Classification, precision and accuracy.
5. Chain and types, tape and types
6. Ranging of lines, direct method and in direct methods
7. Chain and tape corrections
8. Numerical problems on tape corrections
9. EDM devices and Problems

Unit – 2

Topics covered

1. Accessories required, selection of stations and lines, offsets and types
2. Setting out of right angles, use of optical square, prism square, cross staff linear methods of setting out right angles
3. Booking of chain survey work, field book, entries, conventional symbols
4. Obstacles in chain survey, numerical problems
5. Errors in chain survey and precautions to be taken.
6. Measurement of area – by dividing the area into geometrical figures
7. Area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates
8. Introduction to planimeter, digital planimeter. Measurement of volumes-trapezoidal and prismoidal formula
9. Volume from contour maps

Unit – 3

Topics covered

1. Meridians and bearings
2. Principle, working and use of prismatic compass
3. Surveyor's compass, magnetic bearing, true bearings, whole circle bearing and reduced bearing
4. Calculation of bearings, interior angles
5. Numerical problems dip and declination
6. Theodolite and types
7. Fundamental axes and parts of a transit Theodolite, uses of Theodolite
8. Temporary adjustments of a transit Theodolite
9. Measurement of horizontal angles, method of repetitions and reiterations
10. Measurements of vertical angles

Unit – 4

Topics covered

1. Principles and basic definitions of leveling
2. Fundamental axes and relationship and part of a dumpy level
3. Types of adjustments and objectives
4. Temporary adjustments of a dumpy level, curvature and refraction correction
5. Types of leveling, simple levelling, reciprocal levelling
6. Profile levelling, cross sectioning, fly leveling
7. Booking of levels by rise and fall method
8. Booking of levels by height of instrument method
9. Comparison, arithmetic checks on rise and fall method and height of instrument method
10 Fly back leveling, errors and precautions.

Unit – 5

Topics covered

1. Contours and their characteristics
2. Methods of contouring, direct and indirect methods
3. Interpolation techniques, uses of contours
4. Numerical problems on determining intervisibility, grade contours and uses
5. Plane table and accessories
6. Advantages and limitations of plane table survey, orientation and methods of orientation
7. Methods of plotting, radiation, intersection, traversing, resection method
8. Two point and three point problems solution to two point problem by graphical method, solution to three point problem
9. Bessel's graphical method
10. Errors in plane table survey.

2. Explain the tabular column, the repetition and reiteration method to measure horizontal angle.

LINE	LENGTH in m	BEARING
AB	194.1	85^0 30’
BC	201.2	15^0 00’
CD	165.4	285^0 30’
DE	172.6	195^0 30’
EA	?	?

3. State Bowditch rule and transit rule for adjusting a closed traverse. Mention the difference between them if any.

4. Explain latitude & departure. Mention their uses.

5.What do you understand by omitted measurements? List the various cases.

6.What is adjustment in a compass closed transverse? How it is done by Bowditch’s rule and transit rule?

7. Following are the lengths and bearings of a closed traverse ABCDEA Find the omitted measurements of the line CD

Line	Length (m)	Bearing
AB	1150	$65^o30^{'}$
BC	680	30^00^1
CD	X	X
DE	960	345^o
EA	640	205^o

Write components and flow diagram of working of GIS.
Give examples of remote sensing.

UNIT 5

Recognize total station instrument.
Compute distance using total station.
Understand of atmospheric conditions.
Distinguish between terrestrial photogrammetry and aerial photogrammetry.
Recognize types of photographs and geometry of aerial photographs

Review Question

Unit-1

1.What is closing error in closed compass survey? Explain how it is adjusted using Bowditch's rule and Transit rule.
2. Distinguish between
i) Face left and face right conditions
Ii) Transiting and swinging of telescope
3.Briefly explain the method of prolonging a straight line using a theodolite which is not in adjustment.
4.List the uses and advantages of total station
5.What are fundamental lines of a theodolite? With neat sketch state the relationship between fundamental lines of a transit theodolite.
6.List out salient features of Total station.
7. Explain uses of theodolite
8. Define the following with respect to a Vernier theodolite.
i) Face left and face right observation.
ii) Vertical axis and horizontal axis.
9. Explain with tabular column, the repetition and reiteration methods to measure horizontal angle.
10. What are the advantages of total station over conventional instruments?

Unit-2

1. Define the following with respect to a vernier theodolite.
i) face left and face right observation
ii) vertical and horizontal axis
iii) telescope normal and invert

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Define surveying, Classify & Indentify basic principles of surveying.	L 1	L					-	-	-	-	-	-
Compute the distance over sloping ground using chain and tape	L 3	H					-	-	-	-	-	-
Conduct compass traversing	L 1	L					-	-	-	-	-	-
Apply the Knowledge of leveling & its importance in civil engineering.	L 1	L					-	-	-	-	-	-
Understand the concept of plane table surveying	L 1	L					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Define surveying, Classify & Indentify basic principles of surveying.	L 1	1					-	-	-	-	-	-
Compute the distance over sloping ground using chain and tape	L 3	3					-	-	-	-	-	-
Conduct compass traversing	L 1	1					-	-	-	-	-	-
Apply the Knowledge of leveling & its importance in civil engineering.	L 1	1					-	-	-	-	-	-
Understand the concept of plane table surveying	L 1	1					-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

Course Outcomes

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

1. Recognize theodolite, measurement of horizontal & vertical angles, and compute difference in elevation
2. Understand importance of different curves and set out of curves
3. Discuss the contours
4. Apply basic knowledge to handle advanced surveying instruments

Topic Learning Objectives

UNIT 1

Understand Concept of latitude and departure and its application.
Distinguish between closed and open traverse.
Compute included angles given the bearings of legs of a closed traverse.
Determine closing error and its direction.
Explain local attraction and its corrections.

UNIT 2

State trigonometric levelling in surveying.
Determine elevation of objects when the base is accessible and inaccessible.
Distinguish between single plane and double plane method.
Explain basic principles of tacheometric surveying.
Describe reducing the constants in internal focusing telescope.

UNIT 3

Illustrate simple curves, Compound and Reverse curves.
Construct curves by linear methods.
Construct curves by Rankine's deflection angle method.
Differentiate between transition curves and vertical curves.
Develop parts of curves.

UNIT 4

Understand Global positioning systems.
Describe working principle of GPS.
Understand Geographic information system.

Unit-3

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 and Reverse curves: Compound curves, elements of Compound curves, design of compound curves, setting out of compound curves , reverse curve between two parallel straights (Equal radius and unequal radius). **Transition curves and vertical curves:** Introduction to transition curves and vertical curves. Parts of curves and their usage. **12 Hrs**

Unit – 4

Introduction to GPS and GIS:

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

Introduction to Geographic information system, components and flow diagram of working of GIS, four M's its advantages. Introduction to remote sensing, working principle and area of application. **10 Hrs**

Unit-5

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

Photogrammetry: Basic concepts of terrestrial photogrammetry and aerial photogrammetry, photo theodolite, horizontal and vertical angles, horizontal position, types of photographs and geometry of aerial photographs **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. Higher Surveying A.M. Chandra New age international (P) Ltd.
2. Fundamentals of Surveying - Milton O. Schimidt - Wong, Thomson Learning.
3. Fundamentals of Surveying - S.K. Roy - Prentice Hall of India.
4. Surveying, Arther Bannister et al., Pearson Education, India.

Course Code : P13CV35	Semester : III	L - T - P : 4 - 0 - 0
Course Title : FLUID MECHANICS		
Contact Period: Lecture: 52 Hr, Exam:3 Hr	Weightage: CIE:50; SEE:50	
Prerequisites : Nil		

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.

Fluid properties and classification of fluids: Mass density, specific volume, specific weight, relative density, viscosity, Newton's law of viscosity (with units and dimensions) and problems, Newtonian and Non-Newtonian fluids, ideal and real fluids, compressibility, vapor pressure, surface tension, equation for stability of bubble and droplet of liquid, capillarity… theory and problems 10Hrs

Unit-2

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, mechanical pressure gauges. **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. 10 hrs

Unit-3

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, definition of velocity potential, stream function, equipotential line and flownets, relation between velocity potential and stream function, problem on continuity equation, problem on velocity potential and stream function. **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. 12Hrs

Unit – 4

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 gradual closure and sudden closure of valve and problems. 10 Hrs

Unit-5

Flow Measurement: Flow through orifices, classification, vena-contracta and discharge through an orifice. Hydraulic co-efficients 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, classification and equation for discharge over rectangular, triangular and trapezoidal notches and problems, Cippoletti notch, problems. Nappe - Types of Nappe and ventilation of weirs. Broad crested weir, problems, submerged weirs, equation for discharge, problems. 10 Hrs

Text Book:

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.

Course Code : P13CV44	**Semester : IV**	**L - T - P : 4 - 0 - 0**
Course Title : SURVEYING –II		
Contact Period: Lecture: 52 Hr, Exam: Hr		**Weightage: CIE:50; SEE:50**
Prerequisites : Surveying—I		

Course Learning Objectives (CLOs)

This course aims to

1. Recognize theodolite and list parts of theodolite.
2. Give examples on closed and open traverse using theodolite.
3. Compute elevation of objects when the base is accessible and inaccessible.
4. Predict the difference in elevation using trigonometric levelling.
5. Illustrate tacheometric surveying and its uses.
6. Using different methods of tacheometric surveying.
7. Construct simple curves using Rankine's deflection angle method.
8. Design of compound curves and reverse curves.
9. Develop transition curve.
10. Compute vertical curves.

Course Content

Unit – I

Adjustment of Traverse: Concept of latitude and departure and its application, Traverse-closed and open traverse, computation of bearings of legs of closed traverse given the bearing of one of the legs, computation of included angles given the bearings of legs of a closed traverse, checks of closed traverse and determination of closing error and its direction, Bowditch's graphical method of adjustment of closed traverse, Bowditch's rule and transit rule, omitted measurements (only length and corresponding bearing of one line). Local attraction, error determination and corrections. **10** Hrs

Unit-2

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.

Tacheometric Surveying : Basic principle, types of tachometric survey, only numerical problems on horizontal and inclined line of sight. (no derivation), applications analectic lens in external focusing telescopes, reducing the constants in internal focusing telescope

10 Hrs

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Identify structural forms, idealization, stability and determinacy.	L 1	2					-	-	-	-	-	-
Define common problems of trusses	L 2	2					-	-	-	-	-	-
Determine deflection by different methods	L 5	2					-	-	-	-	-	-
Use influence lines for distributed loads and rolling loads	L 5	2					-	-	-	-	-	-
Solve numerical problems	L 3	2					-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

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 11.
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.

Course Outcomes

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

1. Understand the concept of fluid, its relevance in civil engineering, differentiate between fluid and solids, fluid continuum
2. Classify the fluids based on physical properties, and compute various fluid properties.
3. Define the concept of pressure, pressure head, Pascal's law, and measurement of pressure using mechanical gauges and manometers
4. Understand the concept of total pressure, centre of pressure and its computation on a submerged horizontal, vertical and inclined plane surfaces and on the curved immersed surfaces, pressure diagrams
5. Compute head losses in pipe systems. Water hammer in pipes
6. Understand the concept of notches, weirs, classifications,, ventilation of weirs. Measure the flow using notches and weirs.

Topic Learning Objectives

UNIT 1

Define the concept of fluid, its relevance in civil engineering.
Differentiate between fluid and solids, fluid continuum.
Classify the fluids based on physical properties, and compute various fluid properties.
Differentiate between Newtonian and Non-Newtonian fluids.
Solve numerical problems.

UNIT 2

Define the concept of pressure, pressure head, atmospheric pressure, gauge pressure and absolute pressure.
Define Pascal's law and hydrostatic pressure law.
Classify types of pressures and measure pressure using mechanical gauges and manometers.
Apply equation for hydrostatic force and depth of center of pressure on plane surfaces.
Solve numerical problems.

UNIT 3

Define path line, streamline, streak line, stream tube.
Distiguish Lagrangian and Eulerian approaches.
Concept of inertia force and other forces causing motion.
Derive Euler's equation and Bernoulli's equation.
Solve numerical problems.

UNIT 4

Define Reynolds number, hydraulic gradient, energy gradient.
Derive equation for head loss due to friction.
Concept of Pipes in series, pipes in parallel and equivalent pipe.
Distinguish major and minor losses in pipe flow.
Solve numerical problems.

UNIT 5

Define Flow through orifices.
Hydraulic co-efficients of an orifice and relation between them.
Flow over notches.
Derive equation for discharge over rectangular, triangular and trapezoidal notches.
Solve numerical problems.

Review Questions

Unit-1

1.Define density, specific volume, specific weight and viscosity of a fluid.
2. Differentiate between
i) Ideal and real fluid
ii) Compressible and incompressible fluid
iii) Newtonian and non Newtonian fluid
3. Calculate the capillarity in mm when a glass tube of 4mm dia kept immersed in water and mercury. The surface tension of water and mercury are 0.0725N/m and 0.52N/m respectively. W=9810N/mm^3, S=13.6.
4. Explain the phenomenon of capillarity and hence derive an expression for capillary rise of a fluid.
5. The space between the two square flat parallel plates is filled with oil of sp.gr.0.95. the thickness of the oil film is 12.5mm. Each side of plate is 600mm. The upper plate moves at 2.5m/s and requires a force of 100N to maintain this speed. Determine the dynamic viscosity and kinematic viscosity of the oil.
6. Define Surface tension. Prove that relationship between surface tension and pressure inside a droplet a liquid in excess of outside pressure is given by

$$p = \frac{4\sigma}{d}$$

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Identify structural forms, idealization, stability and determinacy.	L 1	M					-	-	-	-	-	-
Define common problems of trusses	L 2	M					-	-	-	-	-	-
Determine deflection by different methods	L 5	M					-	-	-	-	-	-
Use influence lines for distributed loads and rolling loads	L 5	M					-	-	-	-	-	-
Solve numerical problems	L 3	M					-	-	-	-	-	-

L- Low, M- Moderate, H-High

8. Solved problems in deformations of determinate beams
9. frames and trusses using real work
10. Castiglione's and unit load approach.

Unit – 3

1. Introduction to cable structures
2. Analysis of cable subjected to concentrated loads
3. Uniformly distributed vertical loads, length of cable, cable passing over pulley and saddle.
4. Solved problems
5. Introduction to three hinged arches, circular and parabolic arches
6. Circular and parabolic arches with supports at same levels and different levels
7. Determination of thrust, shear and bending moment.
8. Solved problems
9. Introduction to influence lines for reactions
10. Shear force, bending moments in simply supported beam.

Unit – 4

Introduction to statically indeterminate beams
2. analysis of statically indeterminate beams
3. Consistent deformation method (with static indeterminacy ≤ 3)
4. Solved problems
5. Analysis of propped cantilever
6. Solved problems
7. Fixed beams
8. Solved problems
9. Continuous beams.
10. Solved problems.

Unit – 5

1. Analysis of statically indeterminate structures by strain energy method (with static indeterminacy≤ 3)
2. Solved problems
3. Introduction - Strain energy method
4. Analysis of propped cantilever and fixed beams
5. Solved problems.
6. continuous beams.
7. Solved problems.
8. Analysis of statically indeterminate structures by three moment equation. (with static indeterminacy ≤ 3)
9. Introduction - Analysis of continuous beam using Clapeyoran's theorem of three moments,

7.Calculate the specific weight, specific volume & Specific gravity of 1ltr of liquid weighing 133.42 Newtons.

8.The Dynamic viscosity of oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of oil film is 1.5 mm.

9. Determine the specific gravity of a fluid having viscosity 0.07 poise and kinematic viscosity 0.042 stokes.

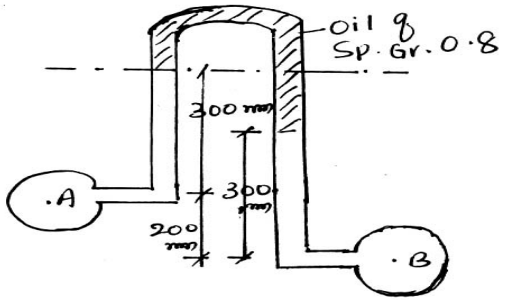
10. Determine the minimum size of a glass tube for the capillary rise in it not to exceed 0.2mm of water. The surface tension of water in contact with air is 0.0725N/m & contact angle 60^0.

Unit-2

1. Derive the expression for pressure head or show that P = wh.
2. What are the devises used for measurement of fluid pressure? Explain any one.
3. A rectangular plane figure 2m wide, 3m deep lies in a vertical plane in water. Determine the total pressure and position of central pressure when the upper surface is horizontal and i) consider with surface of water ii) lies 2.5m below the free surface of water.
4. State and prove Pascal's law of fluid pressure
5. An inverted differential manometer is connected to two pipes A and B carrying water. The sp.gr of manometric liquid is 0.8. The centre of pipe A is 0.15m above the centre of pipe B. The surface of separation of water and oil in the left limb of the U tube to which the pipe A is attached is at a height of 0.3m from the centre of the pipe B and the surface of separation of water and oil in the right limb of the U- tube to which the pipe B is attached is at a height of 0.6m from the centre of B. Determine the difference of pressure in two limbs. Sketch the arrangement
6. Explain how the horizontal and vertical components of and magnitude and direction of the resultant pressure on a submerged curved surface is determined
7.. A vertical sluice gate is used to cover an opening in a dam. The opening is 2m wide and 1.2m high on the upstream of the gate. A liquid of sp.gr.1.45 is retained upto a height of 1.5m above the top of the gate, while on the downstream side water is there upto a height touching the top of the gate. Find the resultant force acting on the gate and position of centre of pressure. Find also

the forces acting horizontally at the top of the gate which is capable of opening it. Assume gate is hinged at bottom.

8An inverted differential manometer in connected to two pipes A & B conveying water. The manometric fluid is of oil of Sp.Gr. 0.8. For the manometer reading shown in Fig, find the pressure difference between A & B in terms of m of water and N/m^2



9. With a neat sketch, explain an inverted differential manometer.

10. Explain how total pressure on a curved surface immersed in a static mass of fluid is measured?

Unit-3

1. Explain different types of flows in a pipe.
2. Derive the Bernoulli's equation from Euler's equation.
3. What is continuity equation? Derive the continuity equation for 2D flow.
4. Define velocity potential function and stream function. Show that the stream lines and equipotential lines meet orthogonally at all points of interaction.

The components of velocity for a 2D flow are given by $u = xy$ and

$v = x^2 - \frac{y^2}{2}$. Check, whether they represent the possible case of flow.

5. Differentiate between;

i) Steady and uniform flow ii) Path line and stream line

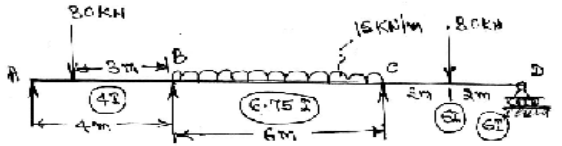
Iii) Stream function and velocity potential function

6.State the clapeyron's theorem of three moments gives its expressions.

7. Determine the reactions at supports of a propped cantilever beam AB, fixed at 'A' and propped at 'B' supporting a udl of W/m over the entire span 'l'. Adopt strain energy method

8. A fixed beam ABCD, fixed at a D is of spans AB = BC = 2 m and CD = 4 m. Beam supports a udl of 16 kN/m over the span BC. Analyse the beam using strain energy method and sketch BMD and SFD.

9. Analyse the continuous beam shown in fig Q8 by using Clapeyorn's three-moment equation and sketch BMD, SFD and elastic curve



10. State the Clapeyron's theorem of three moments and give its expression.

Unit – I

1.Introduction to structural form, idealization, stability and determinacy
2.Skeletal or one dimensional structure, surface structures, idealization of structures
3.Transmission of forces, Principle of superposition. Conditions of equilibrium, degree of freedom
4.Static and kinematic indeterminacy in structures.
5. Solved problems.
6. Introduction to plane trusses, assumptions, common patterns of trusses,
7. Methods of analysis of simple plane trusses - Method of joints and methods of sections
8.Solved problems.
9. Deflection in beams, Moment area method
Solved problems.

Unit – 2

1. Introduction to Deflection**,** Conjugate beam method
2. Solved problems.
3. Energy concepts, complementary energy or work,
4. Forms of elastic strain energy (internal work)
5. Real work and virtual work
6. Betti's law and Maxwell's law,
7. Castigliano's theorem, unit load method.

2. Find the fixed end moments for the fixed beam loaded as shown in fig 4. Analyse the beam using strain energy method.

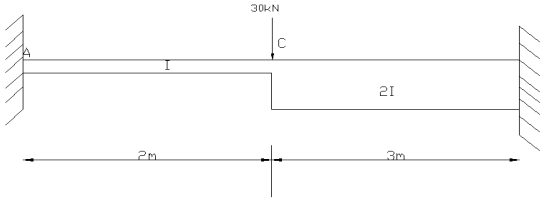
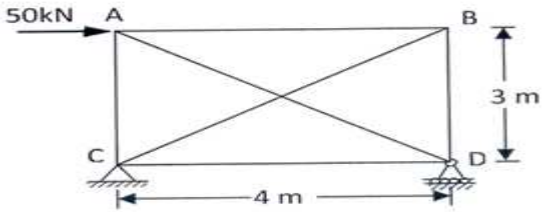


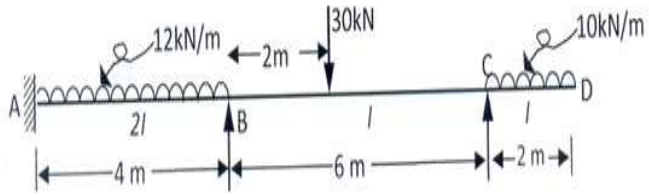
FIG 4

3.Find the force in the member BC of the frame loaded as shown in Fig. using strain energy method. All the members have the same cross sectional area.



4.Develop Clapeyorn's three moment equation to solve continuous beams.

5.A continuous beam loaded as shown in Fig.. The intermediate support B settles by 10mm, determine the resultant moments and reactions at the supports. Hence sketch SFD and BMD. Take E = 210 GPa and I = $5.5 \times 10^7 mm^4$.



6. A pipe line carrying oil of Sp.Gr. 0.87 charges in diameter from 200 mm at a position A to 500 mm at position B, which is 4 m at a higher level. If the pressure at A and B are 100 kPa and 60 kPa respectively and discharge is 0.2 m^3/s. determine the loss of head and direction of flow.

$\frac{(V_1 - V_2)^2}{2g}$ where $V_1 \& V_2$

7. A venturi meter 150 mm X 75 mm is installed in a horizontal pipe of 150 mm dia carrying oil of Sp. Gr 0.9. The mercury level difference in U-tube manometer connected to inlet and throat is 175 mm. Take C_d = 0.97, determine the rate of flow through the pipe.

8. Derive the discharge equation through a horizontal venturi meter filled with a differential manometer.

9. A conical tube of length of 2m is fixed with its smaller end upwards. The velocity of flow at the smaller end is 5 m/s while at the lower end is 2 m/s. The pressure head at the smaller end is 2.5 m of liquid

10. The loss of head in the tube is 0.35 is velocity at smaller and lower end respectively. Determine the pressure at lower end. Assume the flow is in downward direction.

Unit-4

1.explain the following
i) Compound pipe
ii) Hydraulic gradient line
iii) Pipes in parallel
iv) Major losses in pipe

2. Obtain an expression for loss of head due to sudden enlargement.

3. A main pipe divides into two parallel pipes which again forms one pipe. The length and diameter for first parallel pipe are 2000m and 1m respectively, while the length and diameter of second parallel pipes are 2000m and 0.8m. Find the rate of flow in each parallel pipe, if total flow in the main ease $3m^3/s$. take co-efficient of friction for each parallel pipe as 0.005.

4. A pipe of diameter 200 mm and length 2000m connects two reservoir having difference of water levels as 20 m. Determine the discharge through the pipe. If an additional pipe of 200mm diameter and length 1200 m is attached to the last 1200m length of existing pipe. Find the increase in the discharge.

Take f = 0.015, $h_f = \frac{4flv^2}{2gd}$ and neglect minor losses

5.List out the losses that occur in a pipe flow. Give the equation for each of them

6.Water is supplied to a town of 0.5 million inhabitants from a Reservoir 25 km away and the loss of head due to friction in the pipe line is measured as 25 m. Calculate the size of the supply main, if each inhabitant use 200 *l*pd and 65% of the daily supply is pumped in 8½ hours. Take coefficient of friction as 0.0195.

7. A main pipe divides into two parallel pipes which again forms one pipe. The length and diameter for Ist parallel pipe are 2000 m and 1 m respectively, while the length and diameter of 2nd parallel pipes are 2000 m and 0.8 m. Find the rate of flow in each parallel pipe, if total flow in the main is 3 m^3/s. Take coefficient of friction for each parallel pipe as 0.005.

8.What do you understand by major energy loss and minor energy losses in pipes? Derive an expression for head loss due to sudden expansion of flow in a pipe.

9.What is an equivalent pipe? Derive an expression for the equivalent diameter of the compound pipe neglect the minor losses.

10. The difference of water levels of two water reservoirs is 8m. They are connected by a 40m long horizontal pipe. For the first 2m length, the diameter of the pipe is 120mm and for the remaining length the diameter is 200mm, the change in diameter being sudden. Find the discharge in to the lower reservoir. Take f = 0.008 in $h_f = \frac{4\,flv^2}{2\,gd}$.

Unit-5

1.define orifices and mouthpiece. Give detailed classification of orifices and mouth pieces with sketches.

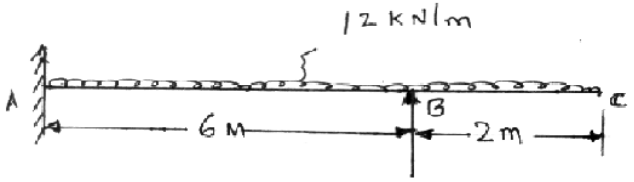
2. Derive an expression for discharge over a rectangular notch listing the advantages of v-notch.

7. A fixed beam ABC, fixed at A, propped at 'C' and supports a concentrated load of 90 kN at B. Spans AB = 6 m and BC = 2 m. Analyze the beam by using consistent deformation method and sketch BMD and SFD.

8. Compute the fixed end moments for a fixed beam of span 'l'm when it carries a UDL of w kN/m throughout the span by using consistent deformation method.

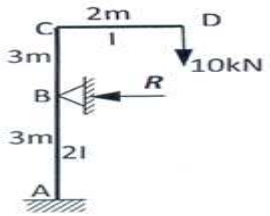
9. Using consistent deformation method, analyse a propped cantilever of span 'l'm carrying a UDL of w kN/m throughout the span. Draw also BMD and SFD.

10.Find the support moments and reactions for the supports for the propped cantilever beam as shown in Fig. Draw neat sketches for BMD and SFD. Indicate all the salient values clearly by consistent deformation method



Unit-5

1. A uniform continuous bar ABCD is built-in at A and laterally supported at B as shown in Fig.. Find the reactive force R at B due to the action of applied load at D as shown. Neglect the effect of direct compression in the vertical portion of the bar. Solve by strain energy approach. Take E = 205 GPa and I = 6.0x10^{7}mm^4.



2. Draw BMD and SFD for the propped cantilever beam loaded as shown in fig 3. EI is constant by consistent deformation method.

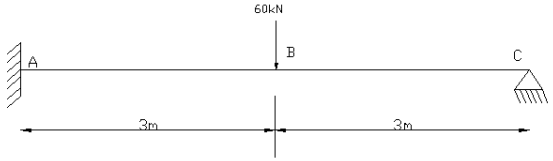
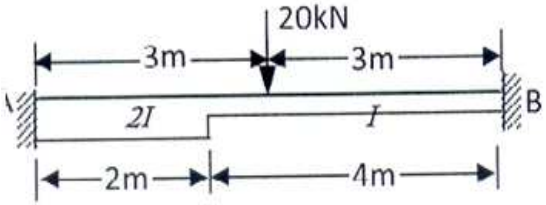


FIG 3

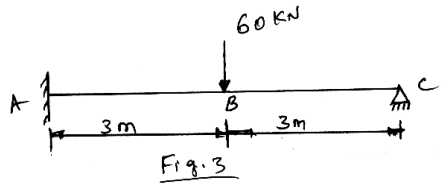
3.By consistent deformation method analyze the Fixed beam loaded as shown in Fig.. Draw SFD and BMD.



4.A propped cantilever beam, ABC is fixed at 'A', propped at 'C' and supports a concentrated load of 90 kN at B. Spans AB = 6m and BC = 2 m. Analyse the beam by using consistent deformation method and sketch BMD and SFD.

5. A fixed beam ABC fixed at 'A' and 'C' supports a udl of 2 kN/m over the portion AB. Spans AB = 6 m and BC = 2 m. Analyse the beam by using consistent deformation method and determine the moments at fixed ends 'A' and 'C'.

6. Draw BMD and SFD for the propped cantilever beam loaded as shown in Fig. 3 EI constant by consistent deformation method.



3. The discharge of 10lps is to be measured by triangular notch of crest angle 600. What would be the head over the crest? If the accuracy of reading the head is 1mm, what error in discharge can be expected? Take c_d=0.6

4. Water discharges at a rate of 98.2 liter/sec through a 120 mm diameter vertical sharp-edged orifice placed under a constant head of 10m. A point on the jet measured from the vena contracta has co-ordinates 4.5 m horizontal & 0.54m vertical. Find the coefficient C_v , C_c and C_d of the orifice

5. Define hydraulic coefficient of an orifice. Explain how they are determined in the laboratory.

6. Water discharges at a rate of 98.2 liter/sec through a 120 mm diameter vertical sharp-edged orifice placed under a constant head of 10m. A point on the jet measured from the vena contracta has co-ordinates 4.5 m horizontal & 0.54m vertical. Find the coefficient C_v , C_c and C_d of the orifice.

7. Water passing over a rectangular notch flows subsequently over right angle V-notch. The length of rectangular notch is 625mm with C_d=0.61 while that of V-notch is 0.6. What will be head over V-notch when the head over rectangular notch is 165mm? Also calculate the percentage error in discharge measurement, if an error 2.5mm is made in the measurement over rectangular notch.

8. Water flows through a triangular right angled weir first and then over a rectangular weir of 1 m width. The discharge co-efficient of the triangular and rectangular weirs are 0.6 and 0.7 respectively. If the depth of water on the triangular weir is 360 mm, find the depth of water over the rectangular weir.

9.Show that the expression for discharge through an external month piece is given by Q = 0.855 av.

10. What is a mouthpiece? What is the advantage of providing the mouthpiece?

Lesson Plan

Unit – I

Topics covered

1. Scope and importance of subject, its relevance in civil engineering definition of fluid, distinction between solids and fluid

2. Distinction between liquid and gas, fluid continuum

3. Mass density, specific volume, specific weight, relative density, viscosity, 4. Newton's law of viscosity (with units and dimensions)

5. Problems on Mass density, specific volume, specific weight, relative density, viscosity.

6. Newtonian and Non-Newtonian fluids, ideal and real fluids compressibility, vapor pressure, surface tension

7. Equation for stability of bubble and droplet of liquid

8. Equation for stability of bubble and droplet of capillarity theory and problems

Unit – 2

Topics covered

1. Definition of pressure, units and dimensions
2. Pressure at a point, Pascal's law, hydrostatic pressure law
3. Atmospheric pressure, gauge pressure and absolute pressure
4. Measurement of pressure, simple manometer theory and problems differential manometer theory and problems, mechanical pressure gauges
5. Definition of total pressure, center of pressure, centroid, centroidal depth, depth of center of pressure
6. Equation for hydrostatic force and depth of center of pressure on plane surfaces (horizontal, vertical and inclined)
7. Problems on hydrostatic force and depth of center of pressure on plane surfaces
8. Hydrostatic force on submerged curved surfaces and problems pressure diagram, problems

Unit – 3

Topics covered

1. Description of fluid flow, Lagrangian and Eulerian approaches
2. Classification of flow, definition of path line, streamline, streak line, stream tube
3. Continuity equation, derivation of continuity equation in differential form
4. Definition of velocity potential, stream function, equipotential line and flownets
5. Relation between velocity potential and stream function, problem on continuity equation
6. Problem on velocity potential and stream function
7. Concept of inertia force and other forces causing motion
8. Derivation of Euler's equation and Bernoulli's equation with assumptions and limitations
9. 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
10. Momentum equation and problems

Unit – 4

Topics covered

1. Flow through pipes, Reynolds number,
2. Definition of hydraulic gradient, energy gradient, major and minor losses in pipe flow
3. Equation for head loss due to friction (Darcy-Weisbach equation), minor losses (types and equations)
4. Problem on minor and major losses

4. A flexible suspension cable of weight 12kN/m hangs between two vertical walls 60m apart, left being attached to wall at a point 10m below right end. A point of load of 200kN is attached to cable in such a manner that point of attachment of load is 20m horizontally from left end wall and 5m below the left hand support. Find the maximum and minimum tension in the cable.

5. A foot bridge is carried over a river of span 60 m. The left support A is 6 m below the right below the right support B. The support B is 9m above the lowest point of the cable. The load on each cable is 30 kN/m of span of bridge. Determine (i) Actual maximum tension induced in cable ii) cross sectional area of the cable required if the permissible tensile stress in the cable is 150 MPa

6. Show that the bending moment at any section of a three hinged parabolic arch of span 'l' central rise 'y_c' supporting a udl of w/m over the entire span is zero.

7. A symmetrical semicircular three hinged arch has a span of 20m. The arch supports a udl of 45 kN/m on the left half of the span.. Determine the horizontal thrust and bending moment, normal thrust and radial shear at a section 6m from the left support.

8. A three hinged parabolic arch of 30 m span and 5 m rise carries a uniformly distributed load of 40 kN/m on its whole span besides a point load of 200 kN placed at a distance 5m from the right end. Find the horizontal thrust, the bending moment, the normal thrust and the radial shear at a section 5 m from left end.

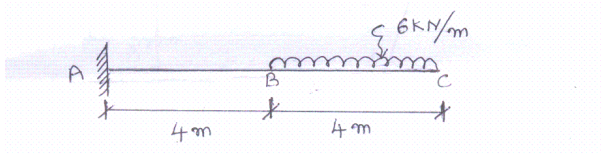
9. A cable is used to support six equal and equidistant loads over a span of 14 m. The central dip of the cable is 1.6 m and the loads are each of magnitude 20 kN. Calculate the length of cable and cross sectional area of the cable required if the maximum stress in the cable is not to exceed 150 MPa

10. A symmetrical three hinged parabolic arch has a span of 20m. It carries a UDL of intensity 10kN/m over entire span and two point loads of 40kN each at 2m and 5m from left hand support. Compute the reactions. Also find the bending moment, radial shear and normal thrust at a section 4m from the left hand support. Take the central rise as 4m.

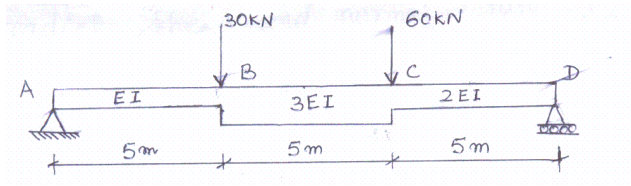
Unit-4

1. A fixed beam ABC, fixed at A, propped at C and supports a concentrated load of 90kN at B. spans AB= 6m and BC=2m. Analyse the beam by using consistent deformation method and sketch BMD and SFD.

8. Find the deflection and the slope at free end for the beam, shown in Fig by using moment area theorem (Take E1=40000 kNm^e)



9. For the simply supported beam shown in Fig. calculate slope and deflection at B by using Conjugate beam method. Assume EI= 4 x 10^6 kN-m^2.



10. A beam ABCDE is 12 m long and supports a load of 100 kN at C. Simply supported at A and E. Portions AB = BC = CD = DE =3 m. Moment of inertia is I in the portions AB and DE, and 2I is in the portion BD. Determine the deflection at point B, C and D by using Conjugate beam method, take E = 2x10^5 N/mm^2, I = 80x10^7 mm$^{4.}$

Unit-3

1. A three hinged parabolic arch of 30m span and 5m rise carries a UDL of 40kN/m on its whole span decides a point load of 200kN placed at a distance 5m from the right end. Find the horizontal thrust, the bending moment, the normal thrust and the radial shear at a section 5m from left end.
2. A cable is used to support 6 equal and equidistant loads over a span of 14m. The central dip of the cable is 1.6m and the loads are each of magnitude 20kN. Calculate the length of cable and cross sectional area of the cable required if the maximum stress in cable is not to exceed 150MPa.

3. A three hinged circular arch of span 20m, rise 5 m is subjected to UDL of intensity 20kN/m for the left half of the span. Determine the reactions at the springing levels. Draw BMD. Also determine the normal thrust and radial shear at a section 8m from left support

4.

5. Pipes in series, pipes in parallel and equivalent pipe, problems
6. Problems
7. Water hammer equation for rise in pressure due to gradual closure of valve
8.Water hammer equation for rise in pressure due to sudden closure of valve
9. Problems on pressure due to gradual closure of valve
10. Problems on pressure due to sudden closure of valve

Unit – 5

Topics covered

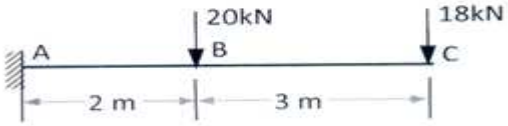
1. Flow through orifices, classification, vena-contracta and discharge through an orifice.
2. Hydraulic co-efficients of an orifice and relation between them equation for co-efficient of velocity, problems on hydraulic coefficients
3. Submerged and large rectangular orifices
4. Flow through mouth pieces, classification, and equation for discharge and pressure head for an external cylindrical mouth piece
5. Flow over notches, classification, equation for discharge over rectangular, triangular and trapezoidal notches
6. Problems on triangular, trapezoidal notches and Cippoletti notch
7. Nappe - Types of nappe and ventilation of weirs. Broad crested weir,
8. Problems on Broad crested weir and Submerged weirs
9. Equation for discharge, problems

Course Articulation Matrix (CAM)

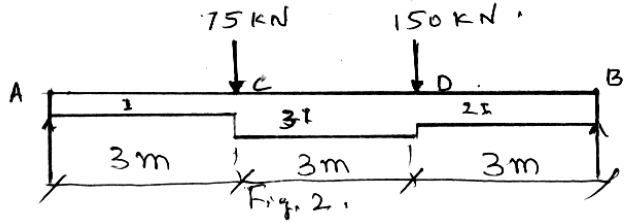
Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Understand the concept of fluid, its relevance in civil engineering, differentiate between fluid and solids, fluid continuum	L 2	M					-	-	-	-	-	-
Classify the fluids based on physical properties, and compute various fluid properties	L 2	L					-	-	-	-	-	-
Define the concept of pressure, pressure head, Pascal's law, and measurement of pressure using mechanical gauges and manometers	L 2	M					-	-	-	-	-	-
Understand the concept of total pressure, centre of pressure and its computation on a submerged horizontal, vertical and inclined plane surfaces and on the curved immersed surfaces, pressure diagrams	L 2	L					-	-	-	-	-	-
Compute head losses in pipe systems. Water hammer in pipes	L 2	M					-	-	-	-	-	-
Understand the concept of notches, weirs, classifications,, ventilation of weirs. Measure the flow using notches and weirs.							-	-	-	-	-	-

L- Low, M- Moderate, H-High

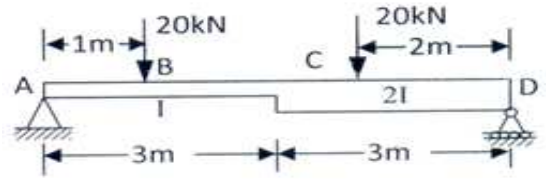
2. Determine the slope and deflection at the free end of a cantilever beam shown in Fig. 2(a) by moment area method (Table El = 8500 kN-m^2).



3. Determine the slope at A and deflection at B and C. Also find the deflection at mid span point simply supported beam shown in Fig. 2(b). Take E = 200GPa and I = 7.0x10^{7}mm^4.

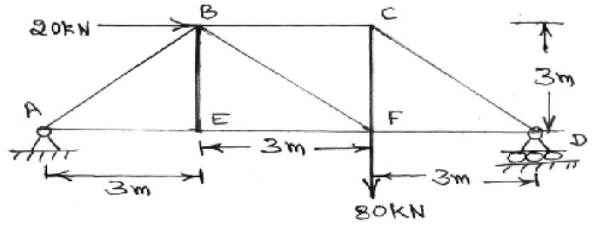


4. State and prove moment area theorems.
5. Using moment area method determine the maximum slope and maximum deflection in a simply supported beam of span 'l' subjected to a udl of W/m over the entire span
6. A cantilever beam ABC is fixed at 'A' and free at point C. The spans AB = BC = 2 m. The beam supports a udl of 20 kN/m over the portion AB and a point load of 40 kN at point C. Determine the maximum slope in the beam and deflection at point B. Portion AB is of moment of Inertia '3I' While that of Portion BC is 'I'. Consider EI = 1x 10^9 kN cm^2.
7.Using conjugate beam method for the beam shown in Fig. 2. Find the slopes and deflections at A, B, C, and D. Given E = 2 x 10^5 N/mm^2 and I = 3 x 10^{10} mm^4



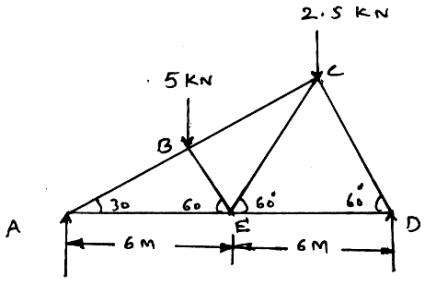
7. Briefly explain the terms 'Statically determinate structures' and' statically indeterminate structures with two examples in each case.

8. Analyse the truss shown in Fig Mark the nature and magnitude of forces induced in all the members of the truss on a neat sketch.



9. What are the assumptions made in the analysis of Trusses?

10. Determine the forces in all the members of the truss shown in figure below. Tabulate the result. Use method of Joints



Unit- **2**

1.Using conjugate beam method for the beam show in fig 2. Find the slopes and deflections at A, B, C & D. given $E=2x10^5N/mm^2$ and $I=3x10^{10}mm^4$.

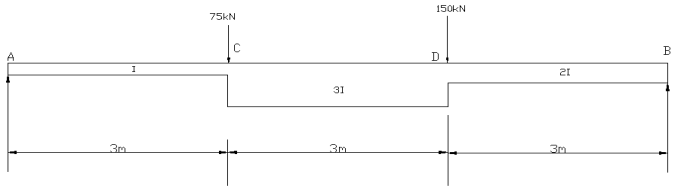


FIG 2

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Understand the concept of fluid, its relevance in civil engineering, differentiate between fluid and solids, fluid continuum	L 2	2					-	-	-	-	-	-
Classify the fluids based on physical properties, and compute various fluid properties	L 2	1					-	-	-	-	-	-
Define the concept of pressure, pressure head, Pascal's law, and measurement of pressure using mechanical gauges and manometers	L 2	2					-	-	-	-	-	-
Understand the concept of total pressure, centre of pressure and its computation on a submerged horizontal, vertical and inclined plane surfaces and on the curved immersed surfaces, pressure diagrams	L 2	1					-	-	-	-	-	-
Compute head losses in pipe systems. Water hammer in pipes	L 2	2					-	-	-	-	-	-
Understand the concept of notches, weirs, classifications,, ventilation of weirs. Measure the flow using notches and weirs.							-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

Course Code : P13CV36	Semester : III	L - T - P : 3 - 0 - 0
Course Title : APPLIED ENGINEERING GEOLOGY		
Contact Period: Lecture: 52Hr, Exam:3 Hr	**Weightage: CIE:50; SEE:50**	
Prerequisites : Nil		

Course Learning Objectives (CLOs)

This course aims to

1. Classify different types of minerals.
2. Understand the engineering importance of rocks.
3. Understand the principles of engineering geology and their applications from civil engineering context.
4. Create an engineering geology model.
5. Define Epi-gene and Hypo-gene agents.
6. To understand the origin of earthquake.
7. Identify different types of landslides.
8. Give examples from engineering considerations against earthquake and earthquake resistant structures.
9. Define dip and strike.
10. Classify folds, joints, faults and unconformities

Course Content

Unit – I

Geology and its scope in Civil Engineering, Earth as planet, its structure and composition

MINERALOGY: Physical properties of minerals, description of physical properties, chemical composition and use of the following minerals-
Quartz and its verities, Orthoclase, Plagioclase, Muscovite Mica, Biotite Mica, Olivine, Asbestos, Kaolin, Talc, Garnet, Corundum, calcite, Dolomite, Magnetite, Gypsum, Magnetite, Limonite, Iron pyrite, Chalcopyrite, Pyrolusite, Chromites, Galena, Bauxite

PETROLOGY: Igneous, Sedimentary and Metamorphic rocks- description and engineering importance of the following rocks.

a) **IGNEOUS ROCKS**: General description - important characters- classification - different forms of igneous bodies – textures in igneous rocks - Granite, Syenite, Diorite, Gabbro, Dunite, Porphyries, Pegmatite, Dolerite, Rhyolite, Pumice Stone, Basalt.

(b). **SEDIMENTARY ROCKS**: General description - important characters – classification – weathering in sedimentary rocks – Soils formation, Soil profile, Classification of Soils, Erosion and Conservation - primary structural features in sedimentary rocks - Conglomerate, Breccia, Sandstone, shale, Limestone, Laterite.

Review Questions

Unit-1

1. Differentiate statically determinate and indeterminate structures with examples.
2. What are the assumptions made in the analysis of trusses?
3. Determine the forces in all the members shown in fig below. Tabulate the results. Use method of joints. Fig. 1

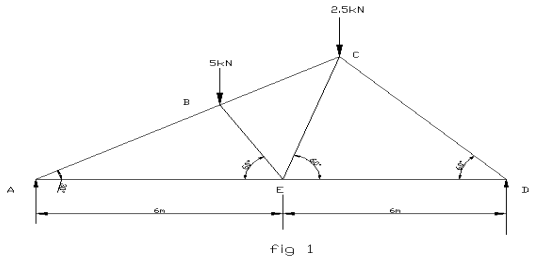
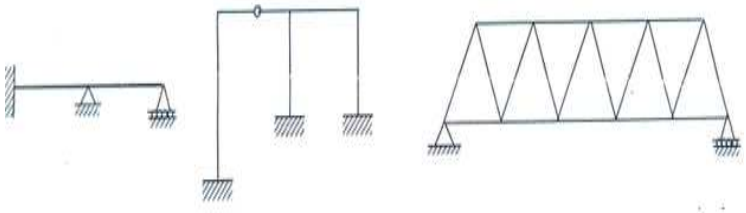
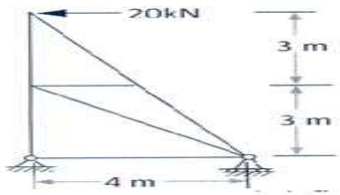


fig 1

4. Define degree of Static indeterminacy and kinematic indeterminacy.
5. Determine the Degrees of indeterminacies for the following structures shown in Fig.



6. . Determine the forces in each member of the pin jointed truss shown in Fig. by using method of joints and tabulate the results.



Topic Learning Objectives

UNIT 1

Recognize skeletal or one dimensional structures.
Give examples for transmission of forces.
Explain Principle of superposition.
Differentiate between static and kinematic indeterminacy in structures.
Solve numerical problems.

UNIT 2

Analyze structures using conjugate beam method.
Understand forms of elastic strain energy.
Analyze structures using Betti's law and Maxwell's law.
Use Castigliano's theorem to analyze structures.
Solve numerical problems.

UNIT 3

Identify cable structures.
Apply different types of loads on cable structures.
Distinguish between Circular and parabolic arches.
Explain Influence lines for reactions, shear force, bending moments in simply supported beam.
Solve numerical problems.

UNIT 4

Understand statically indeterminate beams by consistent deformation method.
Analyze propped cantilever beam using consistent deformation method.
Analyze fixed beam using consistent deformation method.
Analyze continuous beam using consistent deformation method.
Solve numerical problems.

UNIT 5

Understand statically indeterminate structures by strain energy method.
Analyze continuous beam using Clapeyoran's theorem of three moments.
Explain settlement of supports.
Solve numerical problems.

C) METAMORPHIC ROCKS: General description - important characters - different types of metamorphism - Quartzite, Marble, Slate, Phyllite, Schist, and Gneiss. 18 Hrs

Unit-2

PHYSICAL GEOLOGY

Epi-gene and Hypo-gene agents, earthquakes- origin, causes, distribution, effects, engineering considerations against earthquake and earthquake resistant structures. **Landslides-** their causes, types and preventive measures. 6 Hrs

Unit-3

STRUCTURAL GEOLOGY

Out crop, dip and strike, description and use of compass clinometers, classification of folds, joints, faults and unconformities. Their recognition types, uses – importance's of these structures with reference to geo-technology. 10Hrs

Unit-4

ENGINEERING GEOLOGY IN SITE INVESTIGATION

Surface and subsurface investigations for geo-technical problems, Geological considerations in selection site for dams, reservoirs, tunnels, bridges and highways. Silting up of reservoir and remedial measures 8Hrs

Unit-5

GROUND WATER GEOLOGY

Hydrological cycle, water bearing properties of soil and different rocks, aquifers types, applications of geological and geophysical methods, electrical resistivity method, interpretation of resistivity curves for groundwater and Civil Engineering purposes.

GEOMETRICS: Application of remote sensing - Geo-graphical Information System (GIS) techniques in Civil Engineering project, Global Position System (GPS) and its use. 10 Hrs

Text Book:

1. Parbin Singh., **"A Text book of Engineering and General Geology"**- Sixth revised edition- 2011 Published by – S K Kataria & Sons, New Dehli-51.

Reference Books:

1. **B.S. Satyanarayana swamy, "A text book of Engineering Geology"** 2000 edition. Dhanpat rai & Co. (P) Ltd., Delhi-111006
2. K.M. Bangar , "**Principles of Engineering Geology"-** First edition-1995, standard publishers, Delhi-111006

.3. S. K. Garg **"Physical and Engineering Geology"** Third edition 1999-Khanna Publishers, Delhi-111006

4. K.V.G.K Gokhale, **"Principles of Engineering Geology" –** Revised edition 2005, B.S. Publication Hyderabad.
5. D.S. Arora, **"Geology for Engineers"-** Second edition 1982, Mahendra Capital Publishers, Chandigarh-160017.
6. D. Venkata reddy, **"Engineering Geology" – 2011 edition**, Vikas publishing House Pvt. Ltd New Delhi.7. P.K. Mukherjee **"A text book of Geology" -** The World Press Pvt. Ltd. Calcutta 700073.
7. Robert F Legget, **"Geology and Engineers"** – Third **edition** Mc Graw Hill International Edition, Civil Engineering series

Course Outcomes

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

1. Understand the principles of engineering geology and their applications in civil engineering context.
2. Recognize and describe common geological formations with relevance to civil engineering.
3. Demonstrate a basic knowledge of sedimentary, igneous and metamorphic rocks, their formation and occurrence in different tectonic environments.
4. Understand the advanced knowledge and understand the site investigation process for design through testing and interpretation,
5. Create an engineering geology model

Topic Learning Objectives

UNIT 1

Understand Physical properties of minerals.
Identify minerals and its properties.
Distinguish between igneous rocks, sedimentary rocks and metamorphic rocks.

bending moments in simply supported beam. 10 Hrs

Unit – 4

Analysis of statically indeterminate beams by consistent deformation method (with static indeterminacy ≤ 3) :Introduction - Analysis of propped cantilever, fixed beams, continuous beams. Solved problems. 10 Hrs

Unit-5

Analysis of statically indeterminate structures by strain energy method (with static indeterminacy≤ 3) :Introduction - Strain energy method, analysis of propped cantilever and fixed beams, continuous beams. Solved problems.
Analysis of statically indeterminate structures by three moment equation. (with static indeterminacy ≤3) : Introduction - Analysis of continuous beam using Clapeyoran's theorem of three moments, settlement of supports. Solved problems. 12 Hrs

Text Book:

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

Reference Books:

1Strength 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

Course Outcomes

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

1. Identify structural forms, idealization, stability and determinacy.
2. Define common problems of trusses
3. Determine deflection by different methods
4. Use influence lines for distributed loads and rolling loads
5. Solve numerical problems

Course Code : P13CV43	Semester : IV	L - T - P : 4 - 0 - 0
Course Title : ANALYSIS OF STRUCTURES—1		
Contact Period: Lecture: 52 Hr, Exam: Hr	Weightage: CIE:50; SEE:50	
Prerequisites :Strength of Materials		

Course Learning Objectives (CLOs)

This course aims to

1. Identify structural form, idealization, stability and determinacy.
2. Define common problems of trusses.
3. Determine deflection by different methods.
4. Use necessary laws to find deformations in beams, frames and trusses.
5. Analyse thrust, shear and bending moment in cable structures and three hinged arches.
6. Use of influence lines for distributed loads and rolling loads.
7. Analyse statically indeterminate beams using consistent deformation method.
8. Solve numerical problems.
9. Analyse statically indeterminate structures using strain energy method.
10. Solve numerical problems.

Course Content

Unit – I

Structural form, idealization, stability and determinacy: Skeletal or one dimensional structures, surface structures, idealization of structures, transmission of forces, Principle of superposition. Conditions of equilibrium, degree of freedom, static and kinematic indeterminacy in structures. Solved problems. **Plane trusses:** Introduction, assumptions, common patterns of trusses, methods of analysis of simple plane trusses - Method of joints and methods of sections-Solved problems. Deflection in beams-introduction- Moment area method- Solved problems 10 Hrs

Unit-2

Deflection: Conjugate beam method- Solved problems.

Energy concepts-Introduction, complementary energy or work, forms of elastic strain energy (internal work), real work and virtual work, Betti's law and Maxwell's law, Castigliano's theorem, unit load method. Solved problems in deformations of determinate beams, frames and trusses using real work, Castiglione's and unit load approach. 10 Hrs

Unit-3

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

UNIT 2

Define Epi-gene and Hypo-gene agents.
Define earthquake and its effects- & Aseismic building construction.
Explain landslides and its preventive measures.

UNIT 3

Define dip and strike.
Describe compass clinometers.
Classify folds, joints, faults and unconformities– with reference to Civil Engineer.

UNIT 4

Understand surface and subsurface investigations.
Identify geological considerations in selection site for dams, bridges, tunnels & reservoir.
Explain silting up of reservoir and remedial measures.

UNIT 5

Explain water bearing properties of soil and different rocks.
List aquifers types.
Apply geological and geophysical methods.
Describe Geo-graphical Information System (GIS) and Global Position System (GPS).

Review Questions

Unit-1

1. Describe Internal structure of Earth ?
2. Write a Short notes on
   a. Habit, Streak, Hardnen. Luster
3. Explain different forms of Igneous Bodus with a neat sketchs.
4. Define weathering ? Explain briefly about weathering process ? Add a note on importance
5. What is geology? How it is developed? What are the branches you have studied? Mention how the geological knowledge is useful to a Civil Engineer.
6. What is a mineral? Describe the physical properties which are helpful in their identification
7. What are igneous rocks? Describe the forms of igneous rocks.
8. What are sedimentary rocks? Describe the primary structures of sedimentary rocks

9. Describe the following :

CORE, SOIL profile, Agents of metamorphism, & Exfoliation

10.Describe the following:

i) Soil profile ii) Kinds of metamorphism

iii) Aseismic design of buildings

Unit-2

1. What is EQ ? Explain the causes & effects of EQ
2. What is landslide ? Explain the causes & add a note on remedial measures to control landslide

Unit-3

1. Write a short notes on
   a. HORSt & GRABEN
   b. Parts of faults
   c. Unconformities
   d. Joints in Igneous Rocks
2. Define Fold ? Explain different types of folds with neat sketches.

Unit-4

1. Briefly discuss Geological selection site for dam.
2. a) Tunnelling through sedimentary rocks
   b) Selection site for bridges.

Unit-5

1. Define aquifers ? Explain different types of aquifers.
2. a) Cone of depression.
3. b) Rain water harvesting.
4. c) Geophysical Resistivity method of Investigation
5. d) Global position system.

Lesson Planning
Unit – 1

Topics covered

1. Physical properties of minerals.
2. Description of Physical Properties, chemical composition.

use of the following minerals-

3. Quartz & its Verities, Orthoclase, Plagioclase, Muscovite Mica, Biotite Mica, Olivine, Asbestos, Kaolin, Talc.

Course Assessment Matrix (CAM)

Course Outcome (CO)		**Program Outcome** (ABET/NBA-(3a-k))										
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
Apply basic knowledge to evaluate concrete properties.	L 1	**2**					**-**	**-**	**-**	**-**	**-**	**-**
Distinguish between coarse aggregate & fine aggregate and their properties	L 2	**2**					**-**	**-**	**-**	**-**	**-**	**-**
Understand the workability and durability of concrete	L 5	**1**					**-**	**-**	**-**	**-**	**-**	**-**
Discuss chemical admixtures and mineral admixtures.	L 5	**3**					**-**	**-**	**-**	**-**	**-**	**-**
Apply mix design concepts.	L 3	**3**					**-**	**-**	**-**	**-**	**-**	**-**

1 – Low, 2 – Moderate and 3 – High

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Apply basic knowledge to evaluate concrete properties.	L 1	M					-	-	-	-	-	-
Distinguish between coarse aggregate & fine aggregate and their properties	L 2	M					-	-	-	-	-	-
Understand the workability and durability of concrete	L 5	L					-	-	-	-	-	-
Discuss chemical admixtures and mineral admixtures.	L 5	H					-	-	-	-	-	-
Apply mix design concepts.	L 3	H					-	-	-	-	-	-

L- Low, M- Moderate, H-High

4. Use of following minerals Garnet, Corundum, calcite, Dolomite, Magnetite, Gypsum, Magnetite, Limonite, Iron pyrite, chalcopyrite, Pyrolusite, Chromites, Galena, Bauxite
5. Igneous, Sedimentary and Metamorphic rocks- description
Engineering importance of the following different types of rocks.
6. General description - important characters- classification
different forms of igneous bodies – textures in igneous rocks
7. Study of Granite, Syenite, Diorite, Gabbro, Dunite, Porphyries, Pegmatite

Unit – 2

Topics covered

1. Epi-gene & Hypo-gene agents, Earthquakes- origin
2. Causes, distribution and Effects of Earthquake
3. Engineering considerations against earthquake and earthquake Resistant Structures.
4. Introduction to Landslides
5. Causes and types of landslides
6. Preventive measures for landslides

Unit – 3

Topics covered

1. Out crop, Dip & Strike
2. Description and use of Compass clinometers
3. Classification of Folds
4. Classification of Joints
5. Classification of unconformities
6. Recognition of Folds, Joints, Faults & unconformities
7. Uses of recognition
8. Importance of Folds with reference to Geo technology
9. Importance of joints with reference to Geo technology
10. Importance of unconformities with reference to Geo technology

Unit – 4

Topics covered

1. Surface investigations for geo-technical problems
2. Subsurface investigations for geo-technical problems
3. Geological Considerations in selection site for Dams,
4. Geological Considerations in selection site for Reservoirs
5. Considerations in selection site for tunnels,
6. Geological Considerations in selection site bridges & Highways.
7. Silting up of reservoir
8. remedial measures for Silting up of reservoir

Unit – 5

Topics covered

1. Hydrological cycle.
2. Water bearing properties of soil & different rocks
3. Aquifers types
4. Applications of Geological & Geophysical methods
5. Electrical resistivity method
6. Interpretation of resistivity curves for groundwater and Civil Engineering Purposes.
7. Graphical Information System (GIS) techniques in Civil Engineering project.
8. Use of GIS
9. Global Position System (GPS),
10. Use of GPS

specific gravity of cement= 3.15
fly ash= 20% of cementation mat content
specific gravity of fly ash= 2.2

	Sp. Gr	water absorption	free(surface moisture)
coarse aggregate	2.6	0.5%	nil
fine aggregate (belongs to zone II)	2.65	1%	nil

2. What are the factors affecting mix design of concrete ?
3.Briefly describe design of concrete mix by BIS method
4. Briefly describe design of concrete mix by IS method using IS: 10262.
5. Give an introduction to current American (ACI) and British (BS) provision in revised IS code 10262.

Unit-5

1. Define durability of concrete.
2. Write a note on permeability, sulphate attack, chloride attack, and carbonation.
3. What are the factors contributing to cracks in concrete.
4. Explain plastic shrinkage and settlement cracks construction .
5. What are the tests conducted on hardened concrete?
6. Explain compressive strength, split tensile strength and flexural strength of hardened concrete.
7. What are the advantages of non-destructive testing of concrete.
8. Define thermal expansion and transition zone.
9. Write short notes on deficiencies in structural design.
10. What should be the minimum cover to be provided?

6. What are mineral admixtures? Explain.

7.Define workability. Explain how you measure workability of concrete in the laboratory

8. Explain any two chemical admixtures used in making good concrete.

9. Explain Vee – Bee consistometer test for measurement of workability.

10. Briefly explain the different methods of water curing of concrete

Unit-3

1.what are the factors affecting strength of hardened concrete?
2. Define creep? Explain measurement and factors affecting creep.
3. Explain the terms plastic shrinkage and drying shrinkage.
4. Explain with a sketch the effect of w/c ratio on compressive strength of concrete
5. What are the effects of aggregates on strength of concrete ?
6. Define compressive strength, tensile strength, bond strength with respect to concrete.
7. Define modulus of rupture, modulus of elasticity, Poisson ratio and their relationship between these parameters.
8. Explain Accelerated curing and aggregate-cement bond strength.
9. How does water cement ratio influence strength of concrete ?
10. Explain hot weather concreting.

Unit-4

1.design a concrete mix of M25 grade for following data:
Data for proportion:
maximum size of aggregate= 20mm, crushed angular
minimum/maximum cement content= 300/400kg/m^3
max W/C= 0.5
exposure condition = moderate
workability= 100mm slump
method of placing = pumping
quality control = type of chemical admixture = super plasticizer(specific gravity = 1.14)
test data for materials
cement= OPC 43 grade IS 8112

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Understand the principles of engineering geology and their applications in civil engineering context.	L 1	M					-	-	-	-	-	-
Recognize and describe common geological formations with relevance to civil engineering	L 2	M					-	-	-	-	-	-
Demonstrate a basic knowledge of sedimentary, igneous and metamorphic rocks, their formation and occurrence in different tectonic environments.	L 5	M					-	-	-	-	-	-
Understand the advanced knowledge and understand the site investigation process for design through testing and interpretation,	L 5	M					-	-	-	-	-	-
Create an engineering geology model	L 3	M					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Course Assessment Matrix (CAM)												
Course Outcome (CO)		**Program Outcome** (ABET/NBA-(3a-k))										
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
Understand the principles of engineering geology and their applications in civil engineering context.	L 1	**2**					-	-	-	-	-	-
Recognize and describe common geological formations with relevance to civil engineering	L 2	**2**					-	-	-	-	-	-
Demonstrate a basic knowledge of sedimentary, igneous and metamorphic rocks, their formation and occurrence in different tectonic environments.	L 5	**2**					-	-	-	-	-	-
Understand the advanced knowledge and understand the site investigation process for design through testing and interpretation,	L 5	**2**					-	-	-	-	-	-
Create an engineering geology model	L 3	**2**					-	-	-	-	-	-
1 – Low, 2 – Moderate and 3 – High												

UNIT 4

Understand concept of mix design.
Summarize variables in proportioning of concrete.
Explain factors affecting strength of concrete.
Use standard codes in Concrete mix design.
Solve numerical examples.

UNIT 5

Define durability and its significance.
Demonstrate acid attack on concrete.
Interpret factors contributing to cracks in concrete.
Predict strengths of hardened concrete.
Describe non-destructive testing of concrete.

Review Questions
Unit-1

1.what are Bogue's compound? Explain in detail of their influence.
2. Explain structure of hydrated cement.
3. Explain transition zone.
4.Explain the initial setting and final setting time of cement.
5.Explain the phenomenon of bulking in case of fine aggregate
6. Define soundness of cement and explain how it is tested in the laboratory.
7. Explain the importance of size, shape and texture of coarse aggregates in making good concrete.
8. Explain the influence of impurities in water on concrete
9. Explain the terms bulking of sand and Fineness modulus of sand.
10. Explain the terms flakiness index and Elongation index.

Unit-2

1.write a short note on plasticizers.
2.write a short note on super plasticizers (explanation, ,mechanism, classification, new generation super plasticizers) .
3. Explain classification of admixtures and construction chemicals.
4. What is meant by bleeding in concrete? What are its effects on concrete and remedial measures?
5. What are plasticizers? Explain in detail the action of plasticizers in concrete

Course Outcomes

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

1. Apply basic knowledge to evaluate concrete properties.
2. Distinguish between coarse aggregate & fine aggregate and their properties.
3. Understand the workability and durability of concrete.
4. Discuss chemical admixtures and mineral admixtures.
5. Apply mix design concepts.

2. Topic Learning Objectives

UNIT 1

Prepare flow chart of manufacturing OPC.
Understand **Bogue's compound transition zone in cement paste.**
Describe tests on cement.
Explain grading of aggregates.
List the significance and differences of **Manufactured sand.**

UNIT 2

Define workability.
Determine workability by different methods .
Distinguish between Segregation and bleeding.
Explain process of manufacture of concrete.
Describe Mixing, transporting, placing, compaction, curing of concrete.

UNIT 3

Understand water cement ratio and gel/space ratio.
Explain effect of aggregate properties.
Distinguish between compressive strength, tensile strength.
Differentiate plastic shrinkage and drying shrinkage.
Explain creep and its effects on concrete.

Course Code : P13CV37	Semester : III	L - T - P : 0 - 0 - 1.5
Course Title : SURVEY PRACTICE—1		
Contact Period: Lecture: 36 Hr, Exam:3 Hr	**Weightage: CIE:50; SEE:50**	
Prerequisites : Surveying—I		

Course Learning Objectives (CLOs)

This course aims to

1. Identify surveying instruments
2. Construct rectangle, hexagon using tape/chain and other accessories.
3. Construct rectangles, pentagon, hexagon, using tape /chain and compass.
4. Determine the distance between two inaccessible points using chain/tape and compass.
5. determine points using radiation and intersection method of plane tabling.
6. Solve 3-point problem in plane tabling using Bessel's graphical solution.
7. Use fly leveling technique and Rise and Fall methods.
8. Determine difference in elevation between two points using reciprocal leveling.
9. To conduct profile leveling and to draw the longitudinal section
10. Demonstrate Minor instruments - Clinometer, Ceylon ghat tracer, Hand level, Box sextant, Planimeter and Pantagraph..

Course Content

Introduction to surveying instruments (major and minor)

Exercise - 1

ii) Preparation of a chart of conventional symbols and tape.

Exercise - 2

i) Setting out of rectangle, hexagon using tape/chain and other accessories.

Exercise - 3

i) To set out rectangles, pentagon, hexagon, using tape /chain and compass.

Exercise - 4

i) To determine the distance between two inaccessible points using chain/tape and compass.

Exercise - 5

i) To locate points using radiation and intersection method of plane tabling

.**Exercise - 6**
i) To solve 3-point problem in plane tabling using Bessel's graphical solution.

Exercise -7
i) To determine difference in elevation between two points using fly leveling technique and to conduct fly back leveling. Booking of levels using both heights of instrument and Rise and Fall methods.

Exercise - 8
To determine difference in elevation between two points using reciprocal leveling and to determine the collimation error

Exercise - 9
To conduct profile leveling for water supply /sewage line and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level
Demonstration: Minor instruments - Clinometer, Ceylon ghat tracer, Hand level, Box sextant, Planimeter and Pantagraph.

Exercise – 10
Introduction to Theodolite.
horizontal angles, method of repetitions and reiterations, measurements of vertical angles **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 - S.K. Roy - Prentice Hall of India.
3. Fundamentals of Surveying - Milton O. Schimidt - Wong, Thomson Learning.
4. Surveying Vol. I, S.K. Duggal, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.

Unit-3

Hardened concrete: Factors affecting strength, water cement ratio, gel/space ratio, maturity concept, effect of aggregate properties, compressive strength, tensile strength, bond strength, modulus of rupture, modulus of elasticity, Poisson ratio, the relationship between these parameters. Accelerated curing, aggregate-cement bond strength. Shrinkage – plastic shrinkage and drying shrinkage, factors affecting shrinkage. Creep – measurement of creep, factors affecting creep, effect of creep. Hot weather concreting. 10Hrs

Unit – 4

Concrete mix design: Concept of mix design, variables in proportioning, exposure conditions, factors, affective mix design, design of concrete mix by BIS method using IS: 10262. Introduction to current American (ACI) and British (BS) provision in revised IS code 10262- 2009, numerical examples of mix design. 10Hrs

Unit-5

Hardened concrete: Durability – definition, significance, permeability, sulphate attack, chloride attack, and carbonation. Factors contributing to cracks in concrete– plastic shrinkage, settlement cracks construction joints. Thermal expansion, transition zone, deficiencies in structural design. Tests on hardened concrete – compressive strength, split tensile strength, flexural strength, non-destructive testing of concrete. (Detailed test procedures to be covered in laboratory)

10Hrs

Text Book:

1. Shetty MS, Concrete technology, Chand S and Co.
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.

Course Code : P13CV42	Semester : IV	L - T - P : 4 - 0 - 0
Course Title : CONCRETE TECHNOLOGY		
Contact Period: Lecture: 52 Hr, Exam: 3Hr	Weightage: 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. Describe chemical admixtures and mineral admixtures.
5. Explain hardened concrete and its strength properties.
6. Summarize curing, factors affecting creep and shrinkage.
7. Describe mix design of concrete.
8. Solve numerical problems on mix design.
9. Understand durability of hardened concrete.
10. Demonstrate tests on hardened concrete.

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 transition zone in cement paste, 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). Manufactured sand its significance and differences. 12Hrs

Unit-2

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. 10Hrs

Course Outcomes

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

1. Handle various surveying instruments - chain, tape, compass, auto level, Plane table and minor instruments.
2. Construct polygons- triangle, rectangle, pentagon etc by using chain, tape compass.
3. Calculate the difference in elevation by reciprocal leveling, profile leveling for roads, water supply and sewer lines by using auto level.
4. Measure angles and bearings and traversing by using compass.
5. Locate the points by radiation, intersection and solution of 2 and 3 point problems using plane table.

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Handle various surveying instruments - chain, tape, compass, auto level, Plane table and minor instruments.	L 3	H					-	-	-	-	-	-
Construct polygons- triangle, rectangle, pentagon etc by using chain, tape compass	L 3	H					-	-	-	-	-	-
Calculate the difference in elevation by reciprocal leveling, profile leveling for roads, water supply and sewer lines by using auto level.	L 5	H					-	-	-	-	-	-
Measure angles and bearings and traversing by using compass	L 5	H					-	-	-	-	-	-
Locate the points by radiation, intersection and solution of 2 and 3 point problems using plane table.	L 3	M					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Identify various building materials and their practical applications.	L1	2					-	-	-	-	-	-
Evaluate the strength of building materials such as bricks, tiles, timber,	L2	2					-	-	-	-	-	-
Compute the material hardness	L5	2					-	-	-	-	-	-
Evaluate physical properties of fine and coarse aggregates.	L5	2					-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

Course Articulation Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Identify various building materials and their practical applications.	L 1	M					-	-	-	-	-	-
Evaluate the strength of building materials such as bricks, tiles, timber,	L 2	M					-	-	-	-	-	-
Compute the material hardness	L 5	M					-	-	-	-	-	-
Evaluate physical properties of fine and coarse aggregates.	L 5	M					-	-	-	-	-	-

L- Low, M- Moderate, H-High

Course Assessment Matrix (CAM)

Course Outcome (CO)		Program Outcome (ABET/NBA-(3a-k))										
		a	b	c	d	e	f	g	h	i	j	k
Handle various surveying instruments - chain, tape, compass, auto level, Plane table and minor instruments.	L1	3					-	-	-	-	-	-
Construct polygons- triangle, rectangle, pentagon etc by using chain, tape compass	L2	3					-	-	-	-	-	-
Calculate the difference in elevation by reciprocal leveling, profile leveling for roads, water supply and sewer lines by using auto level.	L5	3					-	-	-	-	-	-
Measure angles and bearings and traversing by using compass	L5	3					-	-	-	-	-	-
Locate the points by radiation, intersection and solution of 2 and 3 point problems using plane table.	L3	2					-	-	-	-	-	-

1 – Low, 2 – Moderate and 3 – High

Course Code : P13CV38	Semester : III	L - T - P : 0 - 0 - 1.5
Course Title : BASIC MATERIAL TESTNG LAB		
Contact Period: Lecture: 36 Hr,Exam:3 Hr	**Weightage: CIE:50; SEE:50**	
Prerequisites : Strength of Materials		

Course Learning Objectives (CLOs)

This course aims to

1. Conduct tension test on mild steel and HYSD bars.
2. Conduct compression test of mild steel, cast iron and wood.
3. Conduct bending test on wood under two point loading.
4. Conduct shear test on mild steel.
5. Conduct impact test on mild steel (Charpy and Izod)
6. Conduct hardness tests on ferrous and non-ferrous metals - Brinell's, Rockwell and Vickers tests.
7. Conduct test on bricks and tiles.
8. Conduct tests on fine aggregates - moisture content, specific gravity, bulk density, sieve analysis and bulking.
9. Conduct tests on coarse aggregates - absorption, moisture content, specific gravity, bulk density and sieve analysis.
10. Demonstrate strain gauges and strain indicators.

Course Content

Experiments

1. Tension test on mild steel and HYSD bars.
2. Compression test of mild steel, cast iron and wood.
3. Bending test on wood under two point loading.
4. 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.
10. Demonstration of strain gauges and strain indicators

Text Book:

1. esting 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. Testing of Metallic Materials, Suryanarayana A K, Prentice Hall of India Pvt. Ltd. New Delhi.
3. Relevant IS Codes
4. Material Testing Laboratory Manual, Kukreja C B- Kishore K. Ravi Chawla Standard Publishers & Distributors 1996.
5. Concrete Manual M.L.Gambhir -Dhanpat Rai & Sons- New Delhi. Scheme of Examination:

Course Outcomes

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

1. Identify various building materials and their practical applications.
2. Evaluate the strength of building materials such as bricks, tiles, timber,
3. Steel.
4. Evaluate physical properties of fine and coarse aggregates.
5. Compute the material hardness
6. Evaluate the charpy and Izod impact strengths.