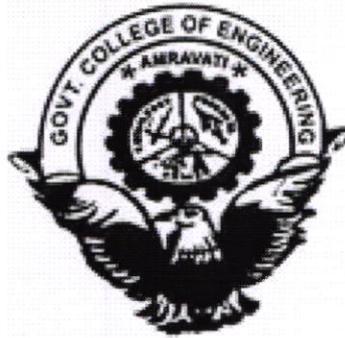


**GOVT. COLLEGE OF ENGINEERING  
AMRAVATI**

**DEPARTMENT OF CIVIL ENGINEERING**



**CURRICULUM**

**For**

**B. TECH. (Civil Engineering)**

**2019 – 20**

## 1. Program Educational Objectives (PEOs)

- Civil Engineering Graduate will be able to identify, formulate, and solve Civil Engineering problems
- Civil Engineering Graduate will be able to deliver the professional and ethical responsibilities
- Civil Engineering Graduate will be able to communicate effectively to function within multidisciplinary teams
- Civil Engineering Graduate will have capability and spirit of lifelong learning to cope up with global trends.



**B. Tech. (Civil Engineering)**

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical			
							MSE	TA	ESE	ICA	ESE	Total	
Basic Science Course	SHU321A	Differential Equations and Probability	3	-	-	3	30	10	60	-	-	100	3
	SHU 322A	*Integral Calculus and Probability											
Professional Core courses	CEU321	Fluid Mechanics	3	-	-	3	30	10	60	-	-	100	3
Professional Core courses	CEU322	Building Materials and Construction	3	-	-	3	30	10	60	-	-	100	3
Professional Core courses	CEU323	Solid Mechanics	3	-	-	3	30	10	60	-	-	100	3
Mandatory courses (noncredit)	SHU323	Introduction to Constitution of India	1	-	-	-	-	20	30	-	-	50	0
Professional Core courses	CEU324	Engineering Geology	3	-	-	3	30	10	60	-	-	100	3
Professional Core courses	CEU325	Building Materials and Construction Lab	-	-	2	2	-	-	-	25	25	50	1
Professional Core courses	CEU326	Engineering Geology Lab	-	-	2	2	-	-	-	25	25	50	1
Professional Core courses	CEU327	Solid Mechanics Lab	-	-	2	2	-	-	-	25	25	50	1
		<b>Total</b>	<b>16</b>	<b>00</b>	<b>06</b>	<b>21</b>	<b>150</b>	<b>70</b>	<b>330</b>	<b>75</b>	<b>75</b>	<b>700</b>	<b>18</b>

\*For Direct Second Year Admitted Students

TA: Teacher's Assessment      MSE: Mid Semester Examination      ESE: End Semester Examination      ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30 Hrs

**B. Tech. (Civil Engineering)**

**SEM -IV**

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical				
							MSE	TA	ESE	ICA	ESE	Total	Credits	
Professional Core courses	CEU421	Hydraulic Engineering	3	-	-	3	30	10	60	-	-	-	100	3
Professional Core courses	CEU422	Surveying	3	-	-	3	30	10	60	-	-	-	100	3
Professional Core courses	CEU423	Transportation Engineering	3	-	-	3	30	10	60	-	-	-	100	3
Professional Core courses	CEU424	Concrete Technology	3	-	-	3	30	10	60	-	-	-	100	3
Professional Core courses	CEU425	Hydrology & Water Resources Engineering	3	-	-	3	30	10	60	-	-	-	100	3
Basic Science	SHU422	Environmental <del>Science</del> <b>Studies</b>	1	-	-	-	-	20	30	-	-	-	50	0
Professional Core courses	CEU426	Hydraulic Engineering Lab	-	-	2	2	-	-	-	25	25	50	1	
Professional Core courses	CEU427	Surveying Lab	-	-	2	2	-	-	-	25	25	50	1	
Professional Core courses	CEU428	Transportation Engineering Lab	-	-	2	2	-	-	-	25	25	50	1	
Professional Core courses	CEU429	Materials, Testing & Evaluation Lab	-	-	2	2	-	-	-	25	25	50	1	
Basic Science	SHU425	Human Values and Ethics	1	-	-	1	-	20	30	-	-	50	0	
		<b>Total</b>	<b>17</b>	<b>00</b>	<b>08</b>	<b>24</b>	<b>150</b>	<b>90</b>	<b>360</b>	<b>100</b>	<b>100</b>	<b>800</b>	<b>19</b>	

TA: Teacher's Assessment      MSE: Mid Semester Examination      ESE: End Semester Examination      ICA: Internal Continuous Assessment  
 ESE Duration for Theory: 2.30 Hrs

**B. Tech. (Civil Engineering)**

Category	Course Code	Name of the Course	SEM- V Teaching Scheme				Evaluation Scheme					Credits	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical			Total
							MSE	TA	ESE	ICA	ESE		
Professional Core Courses	CEU521	Theory of Structures	2	1	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU522	Geotechnical Engineering	3	-	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU523	Water Supply Engineering	3	-	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU524	Design of Steel Structures	3	-	-	3	30	10	60	-	-	100	3
Professional Core Course	CEU525	Advanced Surveying	3	-	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU526	Building Planning & Drawing	2	1	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU527	Geotechnical Engineering Lab	-	-	2	2	-	-	-	25	25	50	1
Professional Core Courses	CEU528	Design of Steel Structures Lab	-	-	2	2	-	-	-	25	25	50	1
Professional Core Courses	CEU529	Building Planning & Drawing Lab	-	-	4	4	-	-	-	25	25	50	2
Professional Core Courses	CEU530	Advanced Surveying Lab	-	-	2	2	-	-	-	25	25	50	1
		<b>Total</b>	<b>16</b>	<b>2</b>	<b>10</b>	<b>28</b>	<b>180</b>	<b>60</b>	<b>360</b>	<b>100</b>	<b>100</b>	<b>800</b>	<b>23</b>

TA: Teacher's Assessment      MSE: Mid Semester Examination      ESE: End Semester Examination      ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30 Hrs

**B. Tech. (Civil Engineering)**

SEM - VI													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical			
							MSE	TA	ESE	ICA	ESE	Total	
Professional Core Courses	CEU621	Design of Reinforced Concrete Structures	3	0	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU622	Estimation & Costing	2	1	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU623	Program Elective – I	3	-	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU624	Program Elective – II	3	-	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU625	Environmental Engineering	3	-	-	3	30	10	60	-	-	100	3
Professional Core Courses	CEU626*	Open Elective I	3	-	-	3	-	-	60	-	-	60	3
Professional Core Courses	CEU627	Design of Reinforced Concrete Structures Lab	-	-	2	2	-	-	-	25	25	50	1
Professional Core Courses	CEU628	Estimation & Costing Lab	-	-	4	4	-	-	-	50	25	75	2
Professional Core Courses	CEU629	Environmental Engineering Lab	-	-	2	2	-	-	-	25	25	50	1
Professional Core Courses	CEU630	Program Elective – II Lab	-	-	2	2	-	-	-	25	25	50	1
Professional Core Courses	CEU631	Minor Project	-	-	2	2	-	-	-	25	-	25	1
		<b>Total</b>	<b>17</b>	<b>01</b>	<b>12</b>	<b>30</b>	<b>150</b>	<b>50</b>	<b>360</b>	<b>150</b>	<b>100</b>	<b>810</b>	<b>24</b>

**\* to be offered for other Departments**

TA: Teacher's Assessment      MSE: Mid Semester Examination      ESE: End Semester Examination      ICA: Internal Continuous Assessment  
 ESE Duration for Theory: 2.30 Hrs

**B. Tech. (Civil Engineering)**

Category	Course Code	Name of the Course	SEM - VII Teaching Scheme					Evaluation Scheme					Credits
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		Total	
							MSE	TA	ESE	ICA	ESE		
Professional Core Courses	CEU721	Advanced Theory of Structures	3	-	-	03	30	10	60	-	-	100	3
Professional Core Courses	CEU722	Foundation Engineering	3	-	-	03	30	10	60	-	-	100	3
Professional Core Courses	CEU723	Program Elective – III	3	-	-	03	30	10	60	-	-	100	3
Professional Core Courses	CEU724	Program Elective IV	3	-	-	03	30	10	60	-	-	100	3
Open subjects	CEU725*	Open Elective II	3	-	-	03	-	-	60	-	-	60	3
Professional Core Courses	CEU726	Advanced Theory of Structures Lab	-	-	02	02	-	-	-	25	25	50	1
Professional Core Courses	CEU727	Foundation Engineering Lab	-	-	02	02	-	-	-	25	25	50	1
Professional Core Courses	CEU728	Civil Engineering Software Lab	-	-	04	04	-	-	-	50	-	50	2
Professional Core Courses	CEU729	Project – Phase I	-	-	04	04	-	-	-	100	-	100	2
Professional Core Courses	CEU730	Seminar	-	-	02	02	-	-	-	50	-	50	1
Professional Core Courses	CEU731	Industrial Training / Industrial Visit	-	-	-	-	-	-	-	25	-	25	1
		<b>Total</b>	<b>15</b>	<b>00</b>	<b>14</b>	<b>29</b>	<b>120</b>	<b>40</b>	<b>300</b>	<b>275</b>	<b>50</b>	<b>785</b>	<b>23</b>

**\* to be offered to other Departments**

TA: Teacher's Assessment    MSE: Mid Semester Examination    ESE: End Semester Examination    ICA: Internal Continuous Assessment  
ESE Duration for Theory: 2.30 Hrs

**B. Tech. (Civil Engineering)**

SEM - VIII													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical			
							MSE	TA	ESE	ICA	ESE	Total	
Professional Core Courses	CEU821	Construction Engineering & Management	3	-	-	03	30	10	60	-	-	100	3
Professional Core Courses	CEU822	Program Elective V	3	-	-	03	30	10	60	-	-	100	3
Professional Core Courses	CEU823	Program Elective VI	3	-	-	03	30	10	60	-	-	100	3
Professional Core Courses	CEU824	*Project – Phase II	-	-	10	10	-	-	-	100	100	200	6
		<b>Total</b>	<b>09</b>	<b>00</b>	<b>10</b>	<b>19</b>	<b>90</b>	<b>30</b>	<b>180</b>	<b>100</b>	<b>100</b>	<b>500</b>	<b>15</b>

\*A) Project Work in the Institute OR B) Industry Internship

TA: Teacher's Assessment

MSE: Mid Semester Examination

ESE: End Semester Examination

ICA: Internal Continuous Assessment

ESE Duration for Theory: 2.30 Hrs

## LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE I CEU623	PROGRAM ELECTIVE II CEU624	PROGRAM ELECTIVE III CEU723	PROGRAM ELECTIVE IV CEU724	PROGRAM ELECTIVE V CEU822	PROGRAM ELECTIVE VI CEU823
<ol style="list-style-type: none"> <li>1. Structural Analysis</li> <li>2. Reliability Analysis of Structures</li> <li>3. Geographic Information Systems and Science</li> <li>4. Railway, Tunnel &amp; Airport Engineering</li> <li>5. Hydraulic Modelling</li> </ol>	<ol style="list-style-type: none"> <li>1. Advanced Design of Steel structures</li> <li>2. Advanced Concrete Technology</li> <li>3. Physico-Chemical Processes for Water Treatment</li> <li>4. Open Channel Flow</li> <li>5. Repairs and Rehabilitation of structures</li> </ol>	<ol style="list-style-type: none"> <li>1. Computer Methods in Structural Analysis</li> <li>2. Masonry Structures</li> <li>3. Solid and Hazardous waste management</li> <li>4. Intelligent Transportation System</li> <li>5. Infrastructure Planning &amp; Management</li> </ol>	<ol style="list-style-type: none"> <li>1. Structural Dynamics</li> <li>2. Prestressed Concrete</li> <li>3. Air and Noise pollution control</li> <li>4. Ground Improvement Technology</li> <li>5. Port, Harbour and Bridge Engineering</li> </ol>	<ol style="list-style-type: none"> <li>1. Finite Element Method</li> <li>2. Advanced Design of Concrete Structures</li> <li>3. Construction Project Planning &amp; System</li> <li>4. Industrial Pollution and Control</li> <li>5. Advanced Foundation Engineering</li> </ol>	<ol style="list-style-type: none"> <li>1. Earthquake Engineering</li> <li>2. Industrial structures</li> <li>3. Design of Hydraulic Structures/Irrigation Engineering</li> <li>4. Pavement Material, Design and Construction</li> <li>5. Geotechnical Investigation and Construction Practices</li> </ol>

**LIST OF OPEN ELECTIVES**

<b>OPEN ELECTIVE I</b> CEU626	<b>OPEN ELECTIVE II</b> CEU725
<ol style="list-style-type: none"><li>1. Introduction to Civil Engineering</li><li>2. Project Management</li><li>3. Construction Techniques</li></ol>	<ol style="list-style-type: none"><li>2. Industrial Building Planning &amp; Design</li><li>3. Interior Designs and Drawing</li><li>4. Environmental Legislation</li><li>5. Disaster Management</li></ol>



**COMPARISON OF SEMESTER-WISE CREDIT DISTRIBUTION IN OLD AND  
PROPOSED STRUCTURE**

<b>SEMESTER</b>	<b>CREDITS IN OLD CURRICULUM</b>	<b>CREDITS IN PROPOSED CURRICULUM</b>
<b>I</b>	<b>23</b>	<b>21</b>
<b>II</b>	<b>23</b>	<b>21</b>
<b>III</b>	<b>23</b>	<b>18</b>
<b>IV</b>	<b>23</b>	<b>19</b>
<b>V</b>	<b>23</b>	<b>23</b>
<b>VI</b>	<b>23</b>	<b>24</b>
<b>VII</b>	<b>23</b>	<b>23</b>
<b>VIII</b>	<b>23</b>	<b>15</b>
<b>Total</b>	<b>184</b>	<b>164</b>



## Equivalence of Second Yr. B. Tech Subjects

As per Previous structure		Equivalence As per Revised Structure w.e.f 2020-21	
Course Codes	Name of Course	Course Codes	Name of Course
<b>III Semester B. Tech</b>			
SHU 301	Engineering Mathematics III	SHU321A	Transforms and Discrete Mathematics
CEU 301	Engineering Geology and Hydrology Lab		NIL #
CEU 302	Fluid Mechanics	CEU321	Fluid Mechanics
CEU 304	Building Construction and Materials	CEU322	Building Materials and Construction
CEU 303	Strength of Materials	CEU323	Solid Mechanics
CEU308	Building Construction and Materials Lab	CEU325	Building Materials and Construction Lab
CEU 305	Engineering Geology and Hydrology Lab	CEU326	NIL #
CEU 307	Strength of Materials Lab	CEU327	Solid Mechanics Lab
<b>IV Semester B. Tech</b>			
CEU 405	Open Channel Flow and Hydraulic Machines	CEU421	Hydraulic Engineering
CEU 403	Surveying	CEU422	Surveying
CEU 402	Transportation Engineering	CEU423	Transportation Engineering
CEU 404	Concrete Technology	CEU424	Concrete Technology
CEU 409	Open Channel Flow and Hydraulic Machines Lab	CEU425	Hydraulic Engineering Lab
CEU 407	Surveying Lab	CEU426	Surveying Lab
CEU 406	Transportation Engineering Lab	CEU427	Transportation Engineering Lab
CEU 408	Concrete Technology Lab	CEU428	Materials, Testing & Evaluation Lab

# Since in Revised Curriculum, Engineering Geology and Hydrology are proposed two distinct courses.

Member Secretary  
BoS Civil Engineering

Chairman  
BoS Civil Engineering

**Equivalence B. Tech. Second Year SH Courses A.Y. 2020-21**

S.N.	Course in old scheme			Equivalent course in new Scheme		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU301	Engineering Mathematics- III	03	SHU321A	Differential Equations And Probability	03
2		No Equivalence		SHU322A	Integral Calculus And Probability	03
3	SHU304	Engineering Mathematics- III	03	SHU321B	Transform And Linear Algebra	04
4		No Equivalence		SHU322B	Differential Equation And Transform	04
5	SHU303	Engineering Mathematics- III	03	SHU321C	Transform And Statistical Methods	04
6		No Equivalence		SHU322C	Integral Calculus And Probability	04
7		No Equivalence		SHU323	Introduction To Constitution Of India	00
8		No Equivalence		SHU324	Effective Technical Communication	03
9		No Equivalence		SHU325	Human Values And Ethics	00
10	SHU203	Environmental Studies	03	SHU422	Environmental Studies	00
11		No Equivalence		SHU425	Human Values And Ethics	00
12		No Equivalence		SHU525	Human Values And Ethics	00
13		No Equivalence		SHU725	Human Values And Ethics	00
14	SHU305	General Proficiency- II	2		No Equivalence	
15	SHU401	Engineering Mathematics- IV	3		No Equivalence	
16	SHU402	Engineering Mathematics Lab	2		No Equivalence	
17	SHU403	Engineering Mathematics Lab	2		No Equivalence	

*Gulhane*

**f/ Head, Mathematics**

*P. Tale*

**Member secretary  
BoS Science & Humanities**

*S. S. Shinde*

**Chairman  
BoS Science & Humanities**

III - Sem B.Tech Civil

SHU321A DIFFERENTIAL EQUATIONS AND PROBABILITY

Teaching Scheme: 03Th+ 00Tut =00 Total  
Evaluation Scheme: 30MSE+60ESE+10TA  
Duration of ESE: 2hrs. 30min.

Total Credits: 03  
Total Marks: 100

Course Objectives:

1. To introduce the solution methodologies for second order Partial Differential Equations.
2. To study applications of partial differential equations in vibration of string and heat flow.
3. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.
4. To introduce different sampling distributions and hypothesis tests.

Laplace Transform: (10 hours)

Definition, Properties of Laplace Transform, Laplace transform of periodic functions. Inverse Laplace transform, convolution theorem, unit step function, delta function, evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method.

Partial Differential Equations: (08 hours)

Solutions of first order linear PDEs, Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

Applications of Partial Differential Equations: (10 hours)

Method of separation of variables, equation of vibrating string, solution of wave equation by D'Alembert's method, one dimensional heat flow, two dimensional heat flow.

Random variables and Probability Distributions: (10hrs)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications.

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 2020, 44<sup>th</sup> edition.
2. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

References:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9<sup>th</sup> Edition, John Wiley & Sons, 2006.
2. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003 (Reprint).
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
4. Advanced Engineering Mathematics, H.K. Das, S. Chand & Company Pvt. Ltd, 2014.
5. Higher Engineering Mathematics, B.V. Ramana, Tata Mc Graw Hill Publishing company Ltd., New Delhi, 2008, 6<sup>th</sup> edition.

Course Outcomes:

After successful completion of this course student will be able to  
CO1. Develop different techniques of solving partial differential equations.

- CO2. Implement these techniques to evaluate the engineering problems.  
CO3. develop techniques needed to calculate probabilities and describe the properties of discrete and continuous distribution functions.  
CO4. do analysis of statistical data with the use of statistical tests in testing hypotheses.

## SHU322A INTEGRAL CALCULUS AND PROBABILITY

**Teaching Scheme: 03Th+ 00Tut =00 Total**  
**Evaluation Scheme: 30MSE+60ESE+10TA**  
**Duration of ESE: 2hrs. 30min.**

**Total Credits: 03**  
**Total Marks: 100**

### Course Objectives:

5. To introduce the solution methodologies for second order Partial Differential Equations.
6. To study applications of partial differential equations in vibration of string and heat flow.
7. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.
8. To introduce different sampling distributions and hypothesis tests.

### Ordinary differential equations of higher orders:(07hours)

Linear differential equation with constant coefficient, complementary function, particular integral, complete solution; method of variation of parameters.

### Integral Calculus :(07 hours)

Beta and Gamma functions and their properties; Evaluation of double integrals (Cartesian & polar), change of order of integration.

### Laplace Transform: (08 hours)

Definition, Properties of Laplace Transform, Laplace transform of periodic functions. Inverse Laplace transform, convolution theorem, unit step function, delta function, solving ODEs by Laplace Transform method.

### Partial Differential Equations: (08 hours)

Solutions of first order linear PDEs, Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

### Random variables and Probability Distributions: (08 hrs)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Binomial, Poisson and Normal distributions and applications.

### Textbooks:

3. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 2020, 44<sup>th</sup> edition.
4. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

### References:

6. Advanced Engineering Mathematics, Erwin Kreyszig, 9<sup>th</sup> Edition, John Wiley & Sons, 2006.
7. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book



theorem, Energy gradient line and Hydraulic gradient line, Impulse momentum equation.

**Flow through pipes:** Major losses and minor losses, Darcy Weisbach equation, Factor affecting friction factor, Coefficient of friction for commercial pipes, Moody's diagram, Flow through simple pipes, Flow through pipes in series, Flow through pipes in parallel, siphons pipes, Equivalent pipes, Water hammer in pipes-causes, effects & remedial measures, Transmission of power through pipe flow

**Flow measurements: Velocity measurements:** Pitot tube- basic principle of working, types, measurement of velocity by Pitot tube

**Discharge measurement for pipes:** Venturimeter-principle, equation for discharge, orifice plate meter **Discharge measurement for tanks:** Orifice-types, flow through circular sharp crested orifice, hydraulic coefficient, time required to empty a reservoir and tank

**Laminar flow:** Relation between shear stress and pressure gradient, Steady laminar flow through circular pipes, Hagen-Poiseuille law (no derivation), Laminar flow between parallel plates

**Flow around immersed objects:** Concept of boundary layer theory, Practical problems involving flow around immersed objects, Drag and lift-definition & expression, Types of drag, Pressure drag on flat plate, Stream line & bluff bodies.

#### **Text Books:**

1. Hydraulics & Fluid Mechanics, Modi and S.M. Seth, 14<sup>th</sup> edition, Standard Book House, New Delhi, 2009
2. Fluid Mechanics, Hydraulics and Hydraulic Machines, Dr. A.K. Arora, 9<sup>th</sup> edition Standard Publishers Distributors, New Delhi, 2009.

#### **Reference Books:**

1. 1000 Solved Problems in Fluid Mechanics, K. Subramanya, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008
2. Fluid Mechanics through Problems, R.J. Gadre, New Age International Publishers, New Delhi, 2011.
3. Fluid Mechanics & its Applications, Vijay Gupta & Santosh K. Gupta, 2<sup>nd</sup> edition, New Age International Publishers, New Delhi, 2011
4. Fluid Mechanics & Machinery, Agrawal S.K., Tata McGraw Hill Publishing Co. Ltd, 1997.

#### **Course Outcomes:**

After Completion of course students will be able to

- CEU321.1** Solve the problems related to fluid statics, kinematics and dynamics  
**CEU321.2** Deal with various velocity and discharge measuring instruments in pipe  
**CEU321.3** Solve problems related to laminar (Viscous) fluid and fluid around immersed objects

# CEU322 BUILDING MATERIALS AND CONSTRUCTION

Teaching scheme: 03 L + 00 T Total 03

Credit:03

Evaluation Scheme: 30 MSE + 10 TA +60ESE

Total Marks: 100

Duration of ESE: 2hrs. 30min.

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## Course Objectives:

- I. To study various types of buildings according to National Building Code
  - II. To study various components of building, their functions
  - III. To introduce basic concepts of Building Construction.
  - IV. To study the properties and use of various building materials
  - V. To study the various methods of construction and temporary structures required for construction of various building components
- 

**Introduction:** Types of building as per National Building Code, Components of buildings and their functions, Types of structures-load bearing, framed and composite structures, their suitability, relative advantages and disadvantages

**Foundation:** Definition, purpose, Loads acting on foundation, Safe bearing capacity of soil- definition, Types of shallow foundation for buildings-spread footings for walls and columns, combined footing for columns, Raft foundation, Setting out for foundation

**Floors & Floor finishes:** Floors- Definition & purpose, Types of R.C.C. floors-R.C.C. slab floor, R.C.C. slab & beam floor, Ribbed floor, Flat Slab, their suitability and construction procedure, Flooring tiles: Types-plain cement tiles, Mosaic tiles, chequered tiles, ceramic tiles, glazed tiles, P.V.C. flooring tiles, Vitrified Tiles

## Doors & Windows:

**Wood based Products:** Industrial timber products-veneer, Ply wood, particle board, fibre board, batten board, block board, pre-laminated boards, laminates.

**Aluminium products:** market forms, powder coating & anodizing of aluminium sections. **Doors-Purpose,** Criteria for location, Sizes, Types of door frames, Methods of fixing door frames, Types of door shutters- fully panelled, flush, louvered, glazed, sliding, revolving, rolling shutter, collapsible door, grilled door, suitability of different types of doors. Types of aluminium doors

**Windows-Purpose,** Criteria for location, Sizes, Types of wooden windows-casement, louvered, glazed, metal windows, Aluminium windows, Corner & bay windows, Ventilators-purpose and types, Grills for windows

**Fixtures and fastenings of doors and windows:** Hinges-types and uses, Bolts-types and uses, Handles and locks

**Lintels:** Lintels-purpose, types and their suitability, details of R.C.C.lintel

**Stairs:** Function, Technical terms, Criteria for location, Requirements of good stair, Types of stairs and their suitability, Design of stair, Lifts types and their suitability, Ramps, Escalators

**Roofs:** Flat & pitched roofs-suitability, Types of steel roof trusses and their suitability, Placing and fixing trusses, Types of roofing sheets, Fixing of roofing sheets to trusses

## Masonry construction:

**Brick Masonry:** Qualities of good bricks, Field and laboratory tests on bricks, Classification of bricks, **Mortars:** Types of mortars and their suitability, Proportion of mortars used for different works, Technical terms in brick masonry, Principles to be observed during construction, Header bond, Stretcher bond, English Bond, Flemish bond

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(1 & 11/2 brick thick walls), Construction procedure, defects in brickmasonry

**Reinforced Brick masonry:** Applications, Advantages, Materials required, Construction procedure

**Concrete block masonry:** Types-solid and hollow, common dimensions, Construction procedure

**Plastering and pointing:** Purpose, Types and their suitability, Procedure of plastering and pointing, Defects in plastering work

**Colouring & painting:**

**Paints :** Types, Procedure of painting old and new masonry surfaces, metal surfaces and wooden surfaces

**Damp proofing:** Causes and effects, Methods of damp proofing, materials required, Water proofing compounds- suitability and uses, Details of cavity wall construction

**Termite Proofing:** Definition, Methods of Termite Proofing

**Joints in structure:** Construction joints-necessity, provision of construction joint in slab, beam and columns, Expansion joints –necessity, location, materials used, details of expansion joints at foundation and roof level for a load bearing and framed structure.

**Formwork & scaffolding:** Form work-types and suitability, Period for removal of formwork, Scaffolding: Necessity, Types, Details of erections

**Text Books:**

1. Building Construction, Sushil Kumar, 19<sup>th</sup> edition, Standard Publishers Distributors, New Delhi, 2008
2. Building Materials, P.C. Verghese, 1<sup>st</sup> edition, Prentice-Hall of India, New Delhi, 2009.
3. Building Materials and Construction, Saurabh Kumar Soni, Reprint 2015, S. K. Kataria & Sons, Daryaganj, New Delhi -110002

**Reference Books:**

- (1) National Building Code of India 2005, B.I.S., 2<sup>nd</sup> revision, Techniz Books International, New Delhi, 2005.
- (2) NFPA 5000: Building Construction & Safety Code, NFPA, Techniz Books International, New Delhi, 2009
- (3) Building Materials & Components for Developing Countries, C.B.R.I., TataMcGraw Hill Publishing Co. New Delhi, 1990.
- (4) Building Construction, Gurucharan Singh, 11 th Edition, Standard Book House, New Delhi 2010

### Course Outcomes

- CEU 322.1. Students will be able to identify various types of Buildings
- CEU 322.2. Students will be able to classify basic components of building
- CEU 322.3. Students will be able to understand the importance and role of each component of building
- CEU 322.4. Students will be able to characterize and understand the use of various building materials
- CEU 322.5. Students will be able to decide suitable construction techniques/methods for various construction works

## CEU323 SOLID MECHANICS

Teaching scheme: 03 L + 00T

Total 03

Credit:03

Evaluation Scheme: 30 MSE + 10 TA +60ESE

Total Marks: 100

Duration of ESE: 2hrs. 30min

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### Course Objectives:

- I. To establish an understanding of fundamental concepts of stresses, strains and response of elastic solid to external loadings.
- II. To provide the knowledge of principles, theorems required for analysis and design of various types of structural members subjected to axial , transverse shear, bending and torsional loadings.
- III. To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics.
- IV. To built the necessary theoretical background for further structural analysis and design courses.

### Course Contents:

#### Simple Stresses and Strains:

Concept of stress and strain, St. Venants principle, types of stresses and strains, Hooke's law, stress-strain diagram for mild steel and brittle material.

Working stress, factor of safety, lateral strain, poissons ratio and volumetric strain. Elastic constants and relationship among them.

Bars of varying section – composite bar of two materials only-temperature stresses.

Strain energy-Resilience-Gradual, sudden, Impact and shock loading and their applications.

#### Principal Stresses and Principal Planes:

General two dimensional stress system. Stress at a point on a plane, principal stresses and principal planes. Mohr's circle of stress, concept of ellipse of stress and its use. Principal strains and circle of strain.

### **Shear Force (S.F.) and Bending Moment (B.M.) Diagrams For Determinate Beams.**

S.F. and B.M. diagrams for cantilever, simply simply supported beams with and without overhangs. Calculation of maximum B.M. and S.F. and location of point of contra flexure due to concentrated load, uniformly distributed loads and uniformly varying loads and moments. Relation among shear force, bending moment and loading intensity.

### **Stresses In Beams (Flexural and Shear):**

(i) Flexural or bending stresses:

Theory of simple bending – Assumption- Derivation of bending equation  $M/I = F/Y = E/R$

Section modulus of rectangular and circular section ( Solid and Hollow). Moment of resistance. Bending stress in solid, hollow and built up sections. Design of simple beam section.

(ii) Shearing Stresses:

Derivation for shear stress in beam, shear stress distribution across various beam sections like rectangular, circular and built up sections.

### **Torsion:**

(i) Derivation of equation and its assumptions. Polar modulus

Application of equation to hollow and solid circular shaft, torsional, circular shaft subjected to combined bending and torsion.

(ii) Thin cylinders and Spheres

Derivation for circumferential stress and longitudinal stress. Calculation of circumferential and longitudinal stresses in a cylinder of thin sphere subjected to internal pressure.

### **Slope and Deflection Of Determinate Beam:**

Relation between moment, slope and deflection, derivation of moment area theorems.

Slope and deflection of statically determinate beams subjected to concentrated loads and uniformly distributed load by Macaulay's Method and Moment area method.(Numerical Examples)

Concept of Conjugate Beam method (No numerical examples)

### **Combined Direct and Bending Stresses:**

Combined direct and bending stresses, applications to short columns with eccentric loads.

### **Text Book:**

1. Mechanics of Materials, Beer and Johnston, Tata McGraw Hill Publication
2. Mechanics of Structures- Vol-I, S.B. Junnarkar, Charotar publication house, 32<sup>th</sup> Edition 2016
3. Strength of Materials, R.Subramanian, Oxford University Press, 2007

**Reference Book:**

1. Mechanics of Materials, Gere and Timoshenko, CBS Publishers
2. Engineering Mechanics of Solids, E.P. Popov, 2<sup>nd</sup> Edition, Prentice Hall India, 1998
3. Strength of Materials, G.H. Ryder, Prentice Hall Publications, 3<sup>rd</sup> Edition, 2002.

**Course Outcomes:**

On completion of course students will be able:

**CEU323.1** Understand basic concepts of stress-strain, and evaluate behavior and other physical properties of elastic isotropic materials.

**CEU323.2** Determine the internal forces in structural elements under different types of loadings (axial, transverse shear, bending, and torsional) and draw their graphical representation.

**CEU323.3** Apply the concept of principal stresses and strains for analysis of structural element.

**CEU323.4** Calculate the deflection at any point on a determinate beam subjected to combination of loads.

**CEU-324 ENGINEERING GEOLOGY**

**Teaching scheme: 03 L + 00 T Total 03 Credit:03**

**Evaluation Scheme: 30 MSE + 10 TA + 60ESE  
ESE: 2hrs. 30min.**

**Total Marks: 100 Duration of**

**Course Objectives:**

- I. To introduce basics of Geology and study different types natural materials like rocks & minerals.
- II. To understand the various natural dynamic processes their influence on the surficial features, natural material and their consequences.
- III. To know the importance of knowledge of Geology helpful for major Civil Engineering projects.

**Introduction** - Objective of Study; Scope of subject; Branches of Geology. General Geology- Surface relief of the earth; External and Internal Agents; Weathering, Erosion, Denudation & Decomposition; Earth Movements; Metamorphism; and Volcanism. Petrology-Rock & minerals, Rock forming, Primary and secondary minerals; Essential & Accessory minerals. Igneous Petrology-Mineral composition, felsic and mafic minerals, Textures, Textural variation. Secondary Rocks & Sedimentary Deposits- Rock weathering Agents; Transportation and consolidation Products of weathering and classification; Study of Common Rock types. Metamorphic Rocks-Agents of metamorphism; Types of metamorphism, Textures; Study of common Rock types.

**Structural Geology**-Study and classification of structures; Concept of Rock Deformation & Tectonics. Dip and Strike. Types of folds, faults, Inlier, Outliers; Joints and fractures; Mode of occurrences in various rocks. Importance of structural elements in Engineering operations. Physical Geology; Geological Action of Rivers; River Rejuvenation and resulting features.

**Earthquakes and Mountain Building;** Earth Movements and Interior of Earth; Seismic zones and occurrence of earthquakes; Types of earthquakes. Mountain building process. Groundwater-Types of Watertable, depth zone & relation between surface relief and watertable; Influence of texture and structure on Ground water; G.W. movement and storage; Geological work of groundwater & effects. Indian Geology-General principles of Stratigraphy and age of earth ; Divisions of Geological time and Time scale. Physiographic division of India and their characteristics; History of Peninsula, Significance and Structural characters; Economic minerals and importance.

**Building Stones**-Requirements of good building stones; Strength, durability, Dressing, Availability; Suitability of common rocks as building stones. Landslides Causes, Role of water, stability of slopes; Prevention of landslides, precautions to be taken while construction of various structures. Case histories Engineering Significance of PGE on Geological Structures  
; Detailed case histories.

**Preliminary Geological Investigations;** Use of geological maps and sections; Verification of surface data and subsurface explorations; Drill holes, test pits, trenches, exploratory drills Interpretation of drilling data & compilation of data; Correlation of surface data with results of subsurface exploration; Limitations of Drilling. Main features that affects the quality of rock engineering and design. Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behavior such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Classification of Rock material strength. Core logging .Rock Quality Designation. Rock mass description.

**Tunneling**-Influence of Geological conditions on design and construction of Tunnels  
;Importance of Geology in Alignment of Tunnel; Difficulties in tunneling related to

lithology, etc Role of groundwater in tunneling ;Troublesome geological conditions; Suitability of common rock types for tunneling; Lined and unlined tunnels; Case histories. Geology of Dam Sites ;Physical and Geological characters; Strength, stability and water tightness ;Preliminary Geological work on dam sites; Conditions for locating dam, Precautions to be taken; Treatment of leaky rocks, faults, dykes, crush zones, etc; Earthquakes in regions of dams; Case histories; Geology of Reservoirs and Bridge Sites; Physical Properties & suitable Geological conditions for Reservoir sites; Importance of Groundwater studies and case-histories; Importance of bridge foundations; PGE for exploration of piers and abutments of bridges; Influence of nature and structures of rock on bridge foundations, Case histories

### **Text Books:**

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. A Text Book of Engineering Geology , Dr R B Gupte, Publication :PUNE VIDYARTHI GRIHA PRAKASHAN (2009 EDITION ).ISBN:8185825033.
4. A text book of Geology, Mukharjee, P.K., The World Press Pvt. Ltd.

### **Reference Books**

1. R.Legget : Geology and Engineering – McGraw Hill Book Co., London
2. FGH Blyth, and M.H. De Freitas, : Geology for Engineers, ELBS. 1974 London

### **Course Outcomes:**

After Completion of course students will able to:

- CEU324.1 Know the fundamental concepts leading to formation of the Earth ; Rocks and Minerals.
- CEU324.2 Develop the ability to perform basic engineering geological assessments and analysis.
- CEU324.3 Understand the relevance of Engineering Geology in complex projects which will strengthen their practical understanding of the subject.

## CEU325 BUILDING MATERIALS AND CONSTRUCTION LAB

Teaching scheme: 02 PTotal02

Credit: 01

Evaluation Scheme: 25 ICA +25ESE

Total Marks:50

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### Prerequisites:

Basic knowledge about various building components, building materials

### Course Objectives:

- I. To draw the free hand sketches of various components of a building
  - II. To prepare the detailed drawings of various building components
  - III. To set out in field, the layout of a building
- 

It is a representative list of practical/exercises. The instructor may choose experiments as per his/her requirements (so as to cover entire contents of the course CEU322) from the list or otherwise.

### List of Practical:

- 1 Drawing free-hand sketches in the Sketch book of following building components
  1. Different types of foundations
  2. Different types of R.C.C.Floors
  3. Line diagrams of different types of steel roof trusses
  4. Different types of stairs (plan and elevations)
  5. Types of bonds in brick masonry –plan and elevation of stretcher & header bond, one brick thick wall in English and Flemish bond, brick columns
  6. Expansion joints at foundation and roof level in load bearing and framed structure
  7. Any one type of scaffolding (elevation and section)
  8. Form work for R.C.C.floor
  9. Section of typical load bearing and framed structure
2. Drawing of following building components on half imperial drawing sheet
  - i. Details of fully panelled/flush door and glazed window, indicating dimensions
  - ii. Design of dog-legged stair from given data and its drawing (plan and section)
  - iii. Details of steel roof truss along with roof covering and fixing at support
  - iv. Preparation of setting-out plan for foundation from given line plan of a two-room building
3. Setting out in field for foundation of building from the plan in sheet no.2(iv)
4. Setting out in field layout of compound wall for plot having curved corner

### Note:

**ICA** - The Internal Continuous Assessment shall be based on practical record and knowledge / skill acquired. The performance shall be assessed exercise wise using continuous assessment in formats A & B.

**ESE** – The End Semester Exam for Practical shall be based on performance in viva-voce

### Course Outcomes:

325.1. Students will be able to explain various buildings components by drawing

the free hand sketches

325.2 Students will be able to prepare the detailed drawings of various building components

325.3 Students will be able to set out in field, the layout of a building

## CEU-326 ENGINEERING GEOLOGY LAB

**Teaching scheme: 02 P**  
**Evaluation Scheme: 25 ICA + 25 ESE**

**Total Credit: 01**  
**Total Marks: 50**

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### Prerequisites:

Basic knowledge about various rocks and minerals.

### Course Educational Objectives:

- I. To understand and identify the various minerals and rocks occurring in nature.
- II. To understand and Construct geological sections from contoured geological maps
- III. To set out in field, for understanding knowledge of complex geology as needed for Civil Engg projects.

It is a representative list of practicals/exercises. The instructor may choose experiments as per his/her requirements (so as to cover entire contents of the course CEU324) from the list or otherwise.

### List of Experiments

1. Identification of the following minerals in hand specimens:

Quartz and its varieties, common varieties of cryptocrystalline and amorphous silica, orthoclase, plagioclase, muscovite, biotite, zeolites, calcite, Iceland spar, gypsum, satin spar, fluorite, barites, tourmaline, beryl, graphite, asbestos, talc, kyanite, garnet, galena, magnetite, haematite, limonite, iron pyrites, chromite, bauxite, azurite, malachite, psilomelane.

2. Identification of the following rock types in hand specimens:

#### Igneous Rocks

Granites, syenites, diorites, gabbros, rhyolites, trachytes, andesites, basalts, varieties of Deccan trap rocks, volcanic breccias, pegmatites, dolerites, graphic granites.

#### Sedimentary Rocks

Laterites, bauxites, conglomerates, breccias, sandstones, quartzites, grits, arkose, shales,

mudstone. Chemical and organic limestones.

### Metamorphic Rocks

Marbles, quartzites, varieties of gneisses, slates, phyllites and varieties of schists.

3. Construction of geological sections from contoured geological maps, interpreting geological features without drawing section, solution of engineering geological problems such as alignment of dams, tunnels, roads, canals, bridges, etc. based on geological maps.
4. A field visit to site of Geological work is mandatory for gaining field knowledge of the subject and a report to be submitted as a part thereof..

#### Note:

**ICA** - The Internal Continuous Assessment shall be based on practical record and knowledge / skill acquired. The performance shall be assessed exercise wise using continuous assessment in formats A &B.

**ESE** – The End Semester Exam for Practical shall be based on actual Practicals performed in Laboratory and viva-voce.

#### Course Outcomes:

After Completion of course students will able to:

- 326.1 The students will get the basic knowledge about natural material like rocks and minerals and their usage as well as their availability.
- 326.2 The students will know the significance of geological investigations for civil engineering projects and site selection as well as for the preparation of feasibility reports and others
- 326.3 The knowledge of subject will also help them to understand the geological maps and language for the discussion on geological reports to resolve civil engineering problems.

## CEU 327 SOLID MECHANICS LAB

**Teaching scheme:02 P    Total 02    Credit: 01**  
**Evaluation Scheme: 25 ICA +25ESE    Total Marks:50**

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#### Course Objectives:

- I. To study the mechanical properties of materials when subjected to different types of loading.
- II. To verify the principals studied in solid mechanics theory by performing experiments in laboratory.

It is a representative list of practicals. The instructor may choose experiment as per his/her requirements (so as to cover entire contents of the course CEU323) from the list or otherwise. Minimum eight experiments should be performed.

#### List of Experiments:

- 1) Tension test on mild steel or TOR steel.
- 2) Hardness tests (Brinell and Rockwell) on mild steel, copper, aluminum, brass and castiron.
- 3) Impact test on mild steel, aluminum, copper, brass, cast iron.
- 4) Shear test on mild steel and aluminum.
- 5) Torsion test on mild steel and cast iron.
- 6) Fatigue test on mild steel.
- 7) Measurement of deflection in statically determinate beam.
- 8) Flexure test on wooden beam.
- 9) Determination of stiffness and modulus of rigidity of spring.
- 10) Compression test on wood ( parallel and perpendicular to grains).
- 11) Strain measurement using Rosette- strain gauge.
- 13) Compression test on metals.

**Course Outcomes:**

On completion of course students will be able to:

- CEU327.1** Performs, tension, shear, torsion and compression tests on solid materials.
- CEU327.2** Determine the toughness of the material using Charpy and Izodtest.
- CEU327.3** Determine the Brinell and Rockwell hardness number of given metal specimen.
- CEU327.4** Estimate the elastic constants through compression test on spring and deflection test on beams.

Note-

**ICA-** The internal continuous assessment shall be based on practical record and knowledge/ Skills acquired. The performances shall be assessed experiment wise using continuous assessment formats

**ESE-** The End Semester Exam for practical shall be viva-voce.

**IV – Sem B. Tech Civil**  
**CEU421 HYDRAULIC ENGINEERING**

Teaching scheme:03L

Total:03

Credit:03

Evaluation Scheme: 30 MSE + 10 TA +60 ESE

Total Marks: 100

Duration of ESE: 2 hrs.30min

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**Course objectives:**

1. To study various equations for flow through prismatic channel and its applications to flow problems
2. To introduce the concepts of model study and its application to flow problems
3. To study the working principles of fluid machinery
4. To introduce the concepts of Gradually varied flow and Rapidly varied flow.

**Uniform Flow through channel:** Types of channels, Geometrical properties of prismatic channel section, types of flow through channel, Characteristics of uniform flow through prismatic channel, Chezy's equation, Mannings equation, Mannings constant for different types of channel surfaces, Economical channel section, Conditions for rectangular & trapezoidal economical channel section, Specific energy of flow, Specific force and specific discharge, specific energy diagram, critical depth, criteria for critical depth, subcritical, critical and supercritical flow, Froude No.

**Velocity measurements:** Current meter-types and working, Floats-types

**Discharge measurement for channels:** Notches-Types, Discharge over rectangular notch, triangular notch, trapezoidal notch, Cippolletti notch, End contraction and velocity of approach, Francis formula, Weirs- discharge over broad crested weir, ventilation of weir Flumes- Venturiflume –working principle and computation of discharge, River gauging by segment method

**Non-uniform flow through channel:** Types of non-uniform flow, Gradually varied flow (GVF) and rapidly varied flow (RVF), Equation of GVF and its alternative solutions, Classification of channel bed slopes, Various GVF profiles, their characteristics and field examples, Rapidly varied flow, Hydraulic jump- definition, location, practical examples of its occurrence, Analysis of hydraulic jump in rectangular channel-relation between conjugate depths, energy dissipation, Classification of jumps, Practical applications of hydraulic jump, Energy dissipation below ogee spillway

**Model investigations:** Buckingham's-phi theorem, Model study-similitude, Types of similarities, Types of forces acting on structures, Force ratios, Non-dimensional numbers and their significance, Reynolds Model law & Froude's Model Law and their applications for model studies of hydraulic structures, Distorted and undistorted models, Scale effect.

**Impact of jet** - Impact of jet on plane and curved surfaces (stationary and moving), when jet striking normally at center of plate.

**Pumps:** Definition and types and suitability

**Centrifugal pump:** Components and their functions, principle, working, priming, power required, Multistage pumps, pumps in series, specific speed

**Reciprocating pumps:** Components and their functions, principle, working, power required, Air vessel and its function

**Modern Pumps:** Deep submersible pumps- Components and working, Jet pumps, turbine pumps

**Hydraulic turbines:** Elements of hydroelectric power generation power plant, Hydraulic turbines-definition, Heads and efficiencies, Classification based on various criteria, Choice of turbine, Specific speed and its significance, Pelton wheel turbine and Francis turbine – suitability, components and their functions.

### Text Books:

1. Hydraulics & Fluid Mechanics, Modi and S.M. Seth, 14th edition, Standard Book House, New Delhi, 2009
2. Fluid Mechanics, Hydraulics and Hydraulic Machines, Dr. A.K. Arora, Standard Publishers Distributors, New Delhi, 9th edition 2009.

### Reference Books:

1. 1000 Solved Problems in Fluid Mechanics, K. Subramanya, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008
2. Fluid Mechanics through Problems, R.J. Gadre, New Age International Publishers, New Delhi, 2011.
3. Fluid Mechanics & its Applications, Vijay Gupta & Santosh K. Gupta, 2nd edition, New Age International Publishers, New Delhi, 2011
4. Fluid Mechanics & Machinery, Agrawal S.K., Tata McGraw Hill Publishing Co. Ltd, 1997.

### Course Outcomes:

After Completion of course students will be able to

- CEU421.1 Apply various equations for flow through prismatic channel
- CEU421.2 Apply to the various model laws to the flow problems
- CEU421.3 Solve the problems of gradually varied flow and Rapidly varied low.
- CEU421.4 Acquired knowledge of working principles of fluid machinery

## CEU422- SURVEYING

Teaching scheme: 03L

Total: 03

Credit: 03

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 hrs. 30 min

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### Course Objectives:

- I. To introduce basic concepts of surveying.
- II. To study the methods of linear and angular measurements.
- III. To use various equipment for surveying, levelling, contouring.
- IV. To apply the knowledge of surveying and levelling on field.

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**Introduction:** Surveying- Necessity & purpose, Classification of survey, principles of surveying, Basic measurements in surveying.

**Linear Measurements:** Instruments for measurement of linear measurements, Chaining a line, Chaining on sloping ground, Offsets-Types, Instruments for marking offsets, Direct and indirect ranging, obstacles in chaining & ranging, errors in measurements, corrections to field measurements, Cross staff survey.

**Angular Measurements:** Prismatic compass, Bearings, local attraction and correction to bearings, calculation of included angles from bearing.

**Chain & Compass surveying:** Reconnaissance, Selection of survey stations, Survey lines,

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Chain & compass traversing- Open & closed traverse, Booking field notes, Plotting of traverse, errors, graphical method of adjustment.

**Plane table surveying:** Objective and equipment required for plane table survey, Methods of plane table - Radiation, Intersection, Traversing and Resection, Orientation of plane table, methods of orientation, Advantages, disadvantages, limitations and errors of plane table surveying.

**Levelling:** Bench mark & its types, Auto level, Digital level, Temporary adjustments, levelling staffs and its types, precautions in levelling, booking of field readings in field book, calculation of RL, Arithmetic checks, Reciprocal levelling, Profile levelling, difficulties, Errors and mistakes in levelling, correction for curvature & refraction.

**Contouring:** Definition, characteristics, contour interval, methods of locating contours, interpolation of contours, contour maps & its uses, contour drawing.

**Planimeter:** Digital planimeter-components, setting, selection of scale, computation of area.

**Theodolite:** Component parts of Transit Theodolite, fundamental lines, temporary adjustment, measurement of horizontal angles, measurement of vertical angles, deflection angles, magnetic bearing, lining in by Theodolite, balancing in by Theodolite, prolonging a straight line, laying off horizontal angle, Theodolite traversing, Computation of consecutive and independent co-ordinates, adjustments of closed traverse, Gale's traverse table.

**Tacheometry:** Principle of stadia method, fixed hair method with vertical staff to determine horizontal distances and elevations of the points. Use of tacheometry in surveying.

**Use of Advance Instruments in Surveys:** Study and use of various electronics equipment's like EDM and Total Station.

#### **TEXT BOOKS:-**

1. Surveying part-I by T.P. Kanetkar and S.V. Kulkarni, Pune Vidyarthi GrihaPrakashan, Pune, 24<sup>th</sup> Edition, 2002
2. Surveying Vol. I and Vol. II, B. C. Punmia, Laxmi Publication (P) New Delhi, 17<sup>th</sup> edition, 2008

#### **REFERENCE BOOKS:-**

1. Surveying Vol. I by S.K. Duggal, Tata McGraw Hill Publishing Company Ltd., New Delhi
2. Surveying Vol. I by Santosh Kumar Garg, Khanna Publishers, New Delhi

#### **Course Outcomes:-**

**After Completion of course students will able to**

CEU422.1 Identify and use suitable equipment for linear and angular measurements.

CEU422.2 Taking accurate measurements, recording the field information, plotting and adjustment of traverse.

CEU422.3 Use different types of surveying and levelling equipment.

CEU422.4 Apply the knowledge of surveying and levelling on field.

## CEU423 TRANSPORTATION ENGINEERING

Teaching scheme:03L

Total03

Credit:03

Evaluation Scheme: 30 MSE + 10 TA +60 ESE

Total Marks: 100

Duration of ESE: 2 hrs.30min

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### Course Objectives:

- I. To introduce basic concepts of Highways, bridges
  - II. To study the properties and use of various highway materials
  - III. To study the geometric design, construction procedure of various pavements and maintenance of highways
  - IV. To study various components of bridges and their functions and hydraulic design of bridge
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### Introduction

Importance of Transportation in National Development, Different modes of transportation and their relative advantages & disadvantages. Characteristics of Road Transport History of Development of Roads in India, road development plans.

**Highway planning & engineering surveys:** Necessity, Planning Surveys, Preparation of Plans, Master plan and its phasing, Highway alignment, Engineering surveys, Drawings and reports, Stages in new Highway Project.

**Highway geometric design & IRC recommendations:** Design controls and criteria, Highway cross sectional elements, Camber, Width of pavement or carriageway, Width of roadway or Formation width, Right of way, Sight distance and its types, Super elevation and its design, Widening of pavement on curves, Gradient, Vertical curves, Method of Introduction of Super elevation and Extra widening in Field. Typical cross section of Highway in cutting and filling

**Highway materials and testing:** Stone aggregates properties and different tests, Bituminous Materials – Bitumen, Tests on bitumen, cutback bitumen, Bituminous emulsions, Tar, Bituminous paving mixes, Design of bituminous mixes – Marshall method

**Design of highway pavement:** Object and requirement of pavement, Types of pavements, Pavement components and their functions, Design factors, Design wheel loads, Design of Flexible pavement by CBR method, Design of Flexible pavement using IRC 37:2001, IRC 37:2012, Fatigue and Rutting failure criteria, Burmisters method for design of two layers and three layers pavements. Wheel load stress, temperature stress in rigid pavements, Design of Rigid pavement, joints in rigid pavement

**Construction of Bituminous pavements** - specifications and gradation of materials in different layers, construction procedure of WBM Type base course, WMM type base course, construction procedure of Dense Bituminous Macadam, Bituminous Macadam, and Bituminous Concrete type wearing course, construction procedure for Surface Dressing, Penetration Macadam,

**Construction of Cement Concrete pavements** - construction of pavement slab, alternate Bay method, continuous construction method. Construction of joints.

**Highway maintenance:** Need for Highway maintenance, General causes of pavement failure, Pavement failures, Classification of maintenance works, Maintenance of W.B.M. roads,

Bituminous surfaces and cement concrete pavements, Strengthening of existing pavements using Benkelman Beam study.

**Highway drainage:** Importance, Surface drainage, Sub-surface drainage

**Bridge Engineering:** Bridge Components and their functions, Abutments, piers and wing walls, bearing, approaches, foundation, Types and choice, Site selection.

Culverts & causeways- Types and selection

Types of major bridges based on various criteria, Suitability of different types.

Design flood discharge, Linear waterway, Scour depth, Afflux, Depth of foundation, Free board, Economic span, IRC recommendations, Data collection

**Text Books:**

1. Highway Engineering, Khanna S.K. & Justo C.E.G., Nem Chand & Bros., Roorkee, 11<sup>th</sup> edition, 2001
2. Elements of Bridges, Tunnels and Railways Engineering, Bindra, S. P., Dhanpat Rai & Sons, Delhi, 2010
3. Principles of Transportation Engineering, Chakroborty P. and Das A., 1<sup>st</sup> edition, PrenticeHall of India, 2009

**Reference Books:**

- 1) Transportation Engineering Vol. I & II, V.N. Vazirani & S.P. Chandola, 7<sup>th</sup> edition, Khanna Publishers, New Delhi, 2003.
- 2) Transportation Engineering: An Introduction, Khisty and Lall, 3<sup>rd</sup> edition, Prentice Hall, 2003.
- 3) Bridge Engineering, Ponnuswamy, S., 2<sup>nd</sup> edition, Tata McGraw Hill Publication, New Delhi, 2007.
- 4) Pavement Design and Materials, Papagiannakis A. T. and Masad E. A., 1<sup>st</sup> Edition, John Willey, 2008.
- 5) Principles of Highway Engineering & Traffic Analysis, Mannering F.L., Walter P.K. and Scott John, 3<sup>rd</sup> edition Willey, 2004.

**Course Outcomes:**

**After Completion of course students will able to**

CEU423.1 understand basic concepts of Highways, bridges

CEU423.2 understand the properties of various Highway materials and their suitability under different conditions

CEU423.3 understand the concept of geometric design of road and use the data for road design

CEU 423.4 design the Highway pavement

CEU423.5 understand the functions of various components of bridge and carry out hydraulic design of bridge.

## CEU424 CONCRETETECHNOLOGY

Teaching Scheme:03L      Total=03  
Evaluation Scheme: 30 MSE + 10 TA +60 ESE  
Duration of ESE: 2 Hrs. 30Min

Credits :03  
Total Marks: 100

### Course Objectives:

- I. To study the ingredients of concrete , their properties and understand their influence on the quality of concrete.
- II. To learn the fundamental procedure of concrete making and understand the various factors those will affect the quality of fresh as well as hardened concrete.
- III. To study the methods of concrete mix proportioning.
- IV. To provide the students with knowledge of special purposes concrete and concreting techniques for extreme environmental conditions.

### Course Content

#### Ingredients of

#### Concrete:

- (i) Cement : Manufacture of Portland cement, chemical composition, hydration of cement, Tests on cement ,Types of cement – Rapid hardening, Low heat, sulphate resisting, hydrophobic, oil-well, colored and white cements.
- (ii) Aggregates: Classification of aggregates, mechanical and physical properties, Bulking, grading of aggregates, tests on aggregates, Artificial and recycled aggregates.

**Fresh Concrete:** (i) Methods of mixing, modes of transporting, placing, compacting and curing of concrete.

(ii) Admixtures: functions, classification, chemical admixtures – plasticizers, super plasticizers, retarders, air entraining agents, Mineral admixtures – fly ash, silica fumes, GGBS, rice husk ash.

**Hardened Concrete:** (i) Strength of concrete- factors affecting strength, stress-strain relation, tensile and compressive strength.

(ii) Time dependent behavior of concrete- creep and shrinkage,  
Significance of permeability and durability, factors reducing durability- chemical attack, temperature, frost action

(iii) Non-destructive testing of concrete: Rebound Hammer test, Ultra sonic pulse velocity test, concrete core test

**Concrete Mix Design:** factors to be considered, method of mix design IS (10262) and IRC- 44 method, acceptance criteria for concrete as per IS specification.

### **Cracks in Concrete and Quality Control of Concrete:**

- (i) Cracks: types of cracks in concrete, causes of cracks, evaluation of cracks, common types of repairs.
- (ii) Quality Control: Factors causing variation in the quality of concrete, Quality assurance measures required in concreting, advantages of quality control.

### **Special Concretes and Concreting in extreme environmental conditions:**

Special concretes: Fiber reinforced concrete, polymer concrete, shotcrete, self compacting concrete, vacuum dewatered concrete.

hot weather concreting, cold weather concreting and underwater concreting.

### **Text Books:**

1. Concrete Technology, M.L.Gambhir, 5<sup>th</sup> Edition, Tata McGraw-Hill Publication.
2. Concrete Technology, M.S.Shetty, S. Chand Publication

### **Reference Books:**

1. Properties of Concrete Technology, A.R.Santhakumar, Oxford University Press, NewDelhi,2007.
2. Properties of Concrete, A.M.Neville, Pearson Education India.

### **Course Outcomes:**

After completion of course students will be able to:

- CEU424.1** Identify and enlist the properties of ingredients and admixtures required to make good concrete.
- CEU424.2** Apply measures to get quality concrete in fresh as well as hardened state and use non-destructive testing procedure for evaluation of concrete properties.
- CEU424.3** Design a Concrete Mix as per IS requirements.
- CEU424.4** Illustrate the salient features of special purpose concrete and concreting techniques for extreme environmental conditions.

## **CEU425 HYDROLOGY AND WATER RESOURCES ENGINEERING**

**Teaching Scheme:03L**      **Total=03**  
**Evaluation Scheme: 30 MSE + 10 TA +60 ESE**  
**Duration of ESE: 2 Hrs. 30Min**

**Credits :03**  
**Total Marks: 100**

### **Course objectives:**

- I. To Introduce the basic concept of hydrological processes and various hydrological parameters
- II. To Impart the knowledge of irrigation engineering to determine crop water requirement
- III. To Study the types of dams and Utilize the knowledge in checking the stability of dam
- IV. To Study the types of spillway and its energy dissipation arrangement

**Introduction to Hydrology** :Hydrological cycle, Precipitation-forms and types, : Infiltration, Evaporation, Transpiration, Eapotranspiration, Runoff: Sources and components of runoff, Hydrograph: Flood hydrographs and its components, Computation of floods.

## **Introduction to Irrigation:** Irrigation Necessity, benefits and disadvantages of irrigation

**Estimating Irrigation Demand:** Cropping seasons & base period, Consumptive use of water , Principal Indian crops and their cropping seasons, Duty and Delta, Factors affecting Duty and Delta, Consumptive use of water, Gross command area, Irrigable command area, Culturable command area, Intensity of Irrigation, Determining the crop water requirement.

**Irrigation Schemes:** Classification of Irrigation Projects, Irrigation Project Structure, Planning of Water Storage Reservoir: Selection of site, various investigations, Area-capacity curve, Reservoir storage zones, Planning of reservoir, Effect of sedimentation, Life of reservoir, Fixing capacity of reservoir, Fixing of Dead Storage & live storage, Fixing of flood and surcharge storage, Fixing Control levels.

**Types of Dams:** Brief introduction of various types of dam, Gravity Dams: Typical layouts of gravity dam, Typical non-overflow section of concrete gravity dams, different components, Galleries-Types and their functions, The expected loadings for gravity dams –different forces acting, Earthquake and its effect on dams, Elementary and Practical profile of gravity dam, Earthen dams: Introduction to Types and elements of earth dam, causes of failure, seepage and drainage arrangement. Typical cross section of zoned section –components and their functions,

**Spillway:** Introduction to types of spillway, energy dissipation below spillway including its type. types of crest gates

**Canals:** Brief introduction of Layout of canal system, Types of canals, Canal alignment, Typical cross sections.

### **Text Books:**

1. Irrigation Water Resources and Water Power Engineering, Dr. P.N. Modi, Standard Book House, New Delhi,2009.
2. Irrigation Engineering and Hydraulic Structures, R. K. Sharma, Oxford and IBH Publishing Company, New Delhi,1994.

### **Reference Books:**

1. Elementary Engineering Hydrology, M. J. Deodhar, Pearson Education2009
2. Concrete Dams, R. S. Vershney, Oxford and IBH Publishing Co., New Delhi, 1982.
3. Theory and Design of Irrigation Structures, R.S. Varshney, S. C. Gupta and R.L. Gupta, Nemchand & Brothers, Roorkee, 1992.

### **Course Outcomes:**

After Completion of course students will able to

- CEU425.1 Gain broad understanding of hydrology and knowledge of different hydrographs
- CEU425.2 Understand various types of dam and its components
- CEU425.3 Understand various types of spillway and its components

## CEU 426 HYDRAULIC ENGINEERING LAB

Teaching scheme:02P Total02  
Evaluation Scheme: 25 ICA +25ESE

Credit: 01  
Total Marks:50

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### Course objectives:

- I. To study the hydraulic jump, and concept of impact of jet
- II. To know the working of Venturimeter / Orifice plate meter
- III. To learn the working principles of fluid machinery

It is a representative list of practical's. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course CEU421) from the list or otherwise. Minimum eight experiments should be performed.

### List of Practicals:

1. Determination of Chezy's / Manning's constant of uniform flow through prismatic channel
2. Calibration of rectangular/triangular notch
3. Determination of conjugate depths, length of jump, loss of head of hydraulic jump in laboratory tilting flume
4. Calibration of laboratory Venturi flume
5. Determination of hydraulic gradient of non-uniform flow in prismatic channel
6. Determination of force due to Impact of jet on plates and vanes
7. Determination of efficiency of reciprocating pumps
8. Determination of efficiency of Centrifugal pumps
9. Study experiment on specific energy diagram

### Note:

**ICA** - The Internal Continuous Assessment shall be based on practical record and knowledge /skill acquired. The performance shall be assessed experiment wise using continuous assessment formats A &B.

**ESE** – The End Semester Exam for Practical shall be based on performance in one of the experiment and may be followed by sample questions.

### Course Outcomes:

**After Completion of course students will be able to**

- CEU426.1** Calibrate of rectangular/triangular notch and Venturiflume
- CEU426.2** Calculate the forces due to impact of jet
- CEU426.3** Determine the Chezy's / Manning's constant of uniform flow through prismatic channel
- CEU426.4** Determine of efficiency pumps

## CEU427- SURVEYING LAB

Teaching scheme:02P Total-02  
Evaluation Scheme:ICA-50,ESE-25

Credit:02  
Total Marks:75

### Course Objectives:-

- I. Use of survey instruments
- II. Take linear and angular measurements
- III. Prepare layouts and plans
- IV. Set out alignments for roads, railways etc

### LIST OF PRACTICAL:-

The list given below is just a guideline. All surveying equipments should be introduced and used before conducting experiments.

- 1) Cross staff survey for measurement of area of field, calculation of area and measurement of area by digital planimeter.
- 2) Chain & compass traversing for survey of a given area, booking notes in field book and plotting of features on ground on A1 size sheet.
- 3) Plane table surveying for survey of a given area and plotting of features on ground on A1 size sheet.
- 4) Profile levelling for minimum 500 m length and Plotting of L-section & cross section of road on A1 size sheet.
- 5) Block contouring for minimum 200x200 m area and Plotting of contour map on A1 size sheet.
- 6) Measuring horizontal angles, vertical angles, deflection angles, magnetic bearing, prolonging straight lines, lying off horizontal angles by Theodolite.
- 6) Computation of horizontal distances and elevations by tachometry for horizontal and inclined sites.
- 7) Measurement of distances, angles, magnetic bearings for a traverse by Total Station.

### LAB WORK

Lab work shall consist of field book, and drawing sheets based on above mentioned Practical's.

### PRACTICAL EXAMINATION

Practical examination shall consist of practical performance for a given problem in field and viva voce based on term work.

### Course Outcomes:-

After completion of course the students will be able to:-

**427.1** Understand the importance and scope of surveying in any engineering project.

**427.2** Apply the principles of surveying and use conventional and advanced surveying instruments for surveying.

**427.3** Execute a Survey Project.

## CEU 428 TRANSPORTATION ENGINEERING LAB

Teaching scheme: 02P  
Evaluation Scheme: 25 ICA + 25 ESE

Total 01

Credit: 01  
Total Marks: 50

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### Course Educational Objectives:

- I. To introduce basic concepts of highway material testing
- II. To decide the suitability of Coarse Aggregates and Bitumen for Road construction by conducting the various tests and comparing with standards
- III. To determine CBR value and using it in the design of flexible pavement

It is a representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course CEU423) from the list or otherwise. Minimum eight experiments should be performed.

### List of Practical:

1. To determine the suitability of Aggregate for Road construction by conducting the various tests such as
  - A) Crushing strength test,
  - B) Los Angeles abrasion test / Deval abrasion test,
  - C) Aggregate impact test,
  - D) Aggregate Shape test - Flakiness index and elongation index determination.
  - E) Determination of specific Gravity of Coarse Aggregates
2. To determine the suitability of Bitumen for Road construction by conducting the various tests such as
  - A) Determination of Bitumen Content by Centrifuge Extractor
  - B) Penetration test,
  - C) Ductility test,
  - D) Viscosity test,
  - E) Softening point test,
  - F) Flash and fire point test.
  - G) Marshall Stability Value
3. Determination of CBR value and design of flexible pavement

### Note:

**ICA** - The Internal Continuous Assessment shall be based on practical record and knowledge / skill acquired. The performance shall be assessed experiment wise using continuous assessment formats A & B.

**ESE** - The End Semester Exam for Practical shall be based on performance in Viva-voce

### Course Outcomes Expected:

- CEU 428.1 Students will be able to understand basic concepts of highway material testing
- CEU 428.2 Students will be able to decide the suitability of Coarse Aggregates and Bitumen for Road construction
- CEU 428.3 They will be able to determine CBR value and using it in the design of flexible pavement

## CEU429 MATERIAL TESTING AND EVALUATION LAB

Teaching Scheme: 02P      Total=02  
Evaluation scheme: 25 ICA+25ESE

Credits: 01  
Total Marks: 50

### Course Objectives:

- I. To test the physical properties of ingredients of concrete like cement, fine and coarse aggregates.
- II. To understand the concept and procedure of different tests conducted on fresh and hardened concrete.
- III. To gain knowledge of proportioning a concrete mix for given specification of ingredients.

It is a representative list of experiments. The instructor may choose experiment as per his/her requirements (so as to cover entire contents of the course CEU424 ) from the list or otherwise. Minimum eight practicals should be performed. From the group of experiments given below, tests of groups 1, 3, 6 and 8 are compulsory while other tests are chosen from remaining groups as required.

### Group of Experiments:

1. Tests on cement -I : Fineness, standard consistency and setting time (initial and final)
2. Tests on cement -II : Soundness and compressive strength
3. Tests on fresh concrete -I: Workability tests i.e. slump test, compaction factor test, flow table test
4. Tests on fresh concrete -II: Effect of admixture on workability and setting time of concrete (plasticizer, super plasticizer, retarder)
5. Tests on aggregates -I: Bulk density and void ratio of fine and coarse aggregates, aggregate crushing value
6. Tests on hardened concrete I : Compressive strength, flexural strength, split tensile strength, modulus of elasticity and modulus of rupture of concrete
7. Tests on hardened concrete II: Non-destructive tests i.e. Rebound Hammer Test, Ultrasonic pulse velocity test
8. Concrete mix design as per IS specifications.
9. Tests on bricks: Compressive strength, water absorption and efflorescence test.

### Course Outcomes:

After completion of course students will be able to:

**CEU429.1** Assess the different physical properties of cement, fine and coarse aggregates at field and in lab to decide their suitability for making concrete.

**CEU429.2** Determine the properties of fresh and hardened concrete to assess quality of concrete.

**CEU429.3** Design concrete mix as per IS specifications.

Note-

**ICA-** The internal continuous assessment shall be based on practical record and knowledge/ Skills acquired. The performances shall be assessed experiment wise using continuous assessment formats.

**ESE-** The End Semester Exam for practical shall be viva-voce.