SYLLAUS	(SEMESTER-III)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE03TBS05	3	1	0	15	15	30	70	100	4
Subject:	Engineering Mathematics-III									

Course Learning Objectives:

Course Learning Objectives:

The students will be able to use of the concepts of correlation, Regression and various types of distributions. To provide students with the skills, knowledge and attitudes required to determine approximate numerical solutions to mathematical problems which cannot always be solved by conventional analytical techniques, and to demonstrate the importance of selecting the right numerical technique for a particular application, and carefully analysing and interpreting the results obtained.

Course Content:

UNIT-1 Correlation & Regression: Scatter diagram, Linear Correlation, Measures of Correlation. Karl Pearson's Coefficient of correlation, Limits for correlation coefficients, Coefficient of correlation for vicariate frequency distribution, Rank correlation, Linear Regression, Equations to the line of Regression. Regression coefficient. Angle between two lines of Regression.

UNIT–2 Theoretical Distributions: Discrete and Continuous probability distribution's .Mathematical expectation, Mean and Variance, Moments, Moments generating function, probability distribution ,Binomial, Poisson and Normal distribution ,Test of significance based on chi-square , T,F, and Z distribution, degree of freedom , conditions for applying X2 (chi-square) test , student's test.

UNIT-3 Introduction of Errors and their Analysis, types of errors, numerical problems on error analysis, curve fitting: method of least squares; Numerical Solution of Algebraic and Transcendental Equations: Graphical method bisection Method, Secant Method, Regula-falsi Method, Newton Raphson Method.

UNIT- 4 The Calculus of Finite Differences: Finite differences, Difference formula, operators and relation between operators. Inverse Operator, Interpolation with equal intervals: - Newton's forward and backward interpolation formula. Interpolation with Unequal intervals: - Lagrange's interpolation Newton's difference formula, inverse interpolation.

UNIT- 5 Numerical Differentiation and Integration: - Numerical Differentiation Newton's forward and Backward difference interpolation formula. Maxima and Minima of a Tabulated function, Numerical Integration :-Trapezoidol rule, simpson's (1/3) rd and (3/8) th rule, Boole's rule, weddle rule.

Text Books:
1) Prasad C "Advanced Engineering mathematics",
3) Dass H.K. "Advanced Engineering mathematics",
4) Ray M. "Mathematics statistics",
5) HigherEngg. Mathematics by Dr. B.S. Grewal– KhannaPublishers.,
6) Advanced Engg. Mathematics by Erwin Kreyszig – John Wiley & Sons,
7) Advanced Engg.Mathematics by R.K. Jain and S.R.K. Iyengar – Narosa Publishing House.,
8) Applied Mathematics by P.N.Wartikar& J.N. Wartikar. Vol- II– Pune VidyarthiGrihaPrakashan,Pune.,
9) JAIN & IYNGAR Numerical Methods for Scientific and Engineering Computations.

10) RAO G.S. Numerical Anlysis.

11) Grewal B S Numerical Methods In Engineering and Science.

12) Rajaraman V Computer Oriented Numerical Methods

13) P. Kandasamy K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company,
   2nd Edition, Reprint 2012.

   14) S. S. Sastry, Introduction methods of Numerical Analysis, PHI, 4th Edition, 2005.

Course Outcomes-

After successful completion of this course, the students will be able to

- Understand the statistical concept of correlation regression and distribution, theory with special reforms to engineering problems.
- Analyse the errors obtained in the numerical solution of problems.
- Using appropriate numerical methods, determine the solutions to given non-linear equations.
- Using appropriate numerical methods, determine approximate solutions to systems of linear equations.
- Using appropriate numerical methods, determine approximate solutions to ordinary differential equations.

SYLLAUS	**(SEMESTER-III)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE03TPC01	L	T	P	CT-1	CT-II	TOTAL	70	100	04
Subject:	Strength of Materials	3	1	0	15	15	30			

Course Learning Objectives:

The objective of this Course is to

- To determine the Mechanical behavior of the body by determining the stresses, strains produced by the application of load.
- To apply the fundamentals of simple stresses and strains.
- To facilitate the concept of bending and its theoretical analysis.
- To apply fundamental concepts related to deformation, moment of inertia, load carrying capacity, shear forces, bending moments, torsional moments, column, principal stresses and strains.

Course Content:

UNIT-1: Simple Stresses -Strain and compound stresses: Types of stresses and strains, Mechanicals properties, Hooke's law, stress– strain curve for mild & Cast iron, hardness, impact strength, Poisson's ratio, Relation between the elastic moduli & Poisson's ratio, Bars subjected to varying loads, Temperature stresses in composite bars, Elongation of bars of constant and varying sections. Stress at a point. Components of stress in rectangular coordinates, stresses on an inclined plane, Principal stresses & principle plane, Mohr's circle of stresses.

UNIT-2: Shear Force - Bending Moment: Shear Force & Bending Moment diagrams in statically determinate beams loaded with different load combination, Relationship between Load intensity- Shear Force - Bending Moment, Thrust diagram, Point of contra flexure, loading diagram & Bending moment diagram from shear force diagram, beam with internal hinge. Bending Stress

UNIT-3: Shear Stresses in Beams Derivation of Shear Stress formula, assumptions, and Shear stresses in symmetrical elastic beam with different sections.

Slope and Deflections of simple Beams: Derivation of differential equation for deflection, Slope & Deflection of Beams by Double integration method, Macaulay's method & Moment area method.

UNIT -4: Torsion: Equation of Pure Torsion, Assumptions, and Power transmitted, Stiffness of Shafts, Comparison of Solid & Hollow shaft, Strain energy in Torsion.

Columns: Stable and unstable equilibrium, Short columns, Euler's formula for long columns, Equivalent length, Limitation of Euler's formula, Rankine's formula.

UNIT -5: Thin-walled pressure vessels: Cylindrical pressure vessels, Spherical vessels. Thick Cylindrical vessels: Lame's theory, Graphical method for determining stresses Spherical shells.

Text Books:

1. Strength of Materials – R.K. Rajput (S. Chand & Co.)
2. Mechanics of Structures (Vol. – I) – Junarkar (Charotar Publications)
3. Strength of Materials – Timoshenko, S. & Gere (CBS Publishers)
4. Introductions to Solid Mechanics –Shames &Pitarresi (Prentice Hall of India)
5. Engineering Mechanics of Solid – Popov (Pearson Publication)
6. Strength of Materials–S. Ramamurtham (DhanpatRai Publications)
7. Strength of Materials (Part-I) – Timoshenko (CBS Pubishers)

Course Outcomes- At the end of the course the students will be able

- Describe the concepts and principles of stress and strain, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations of stress and strain due to axial load and temperature.
- To calculate the stresses on an inclined plane, principle stresses and also using Mohr's circle
- To analyse the determinate beams for internal stress resultants (SF, BM and AF) and plot the shear force and bending moment diagrams
- Analyse various situations involving structural members subjected to bending, shear and torsion.
- Calculate the deflection at any point on a beam subjected to a combination of loads.
- Differentiate the types of columns and their analysis
- Analyse the stresses in thin and thick shells
  .

SYLLAUS	**(SEMESTER-III)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE03TPC02	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	Fluid Mechanics- I	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the basic fluid properties and its buoyancy characteristics.
- To understand the kinematics of fluid.
- To learn the dynamics of fluid and discharge and velocity measuring equipment.
- To learn the characteristics of fluid in pipes and its losses.
- To learn the discharge measurement in open channel and pipes.

Course Content:

UNIT-1: Introduction: Fluid, physical properties of fluids ideal and real fluid, Newtonian and Non-Newtonian Fluid Statics: Pressure density height relationship, pressure measurement by Manometers, Pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, metacentric height.

UNIT-2: Kinematics of fluid flow : Steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, one, two and three dimensional flow, streamlines and path lines, rotational and irrotational flow, continuity equation, three dimensional continuity equation. Velocity potential and stream function.

UNIT-3: Dynamics of fluid flow: Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications – Pitot tube, Venturimeter, orificemeter, and problems related to application of momentum equations.

UNIT-4: Flow in Pipes: Major and minor losses in pipe lines, loss due to sudden contraction & expansion, Pipes in series and parallel Flow in open Channel: Comparison between open channel and pipe flow, definition of uniform and non-uniform flow, Chezy's and Manning's Formula, Hydraulically efficient channel section of rectangular, trapezoidal.

UNIT -5: Flow through mouthpieces and orifices: Hydraulic coefficients of orifice, flow through large rectangular orifice, mouthpieces, Borda's mouthpieces. Notches and Weirs: Rectangular, triangular and trapezoidal notches and weir, cippoletti and broad crested weir.

Name of Text Books:
1. Fluid Mechanics and Machines – Dr. A.K. Jain (Khanna Publications)
2. Fluid Mechanics and Machines – Dr. R.K. Bansal (Laxmi Publications)
3. Fluid Mechanics & Hydraulic Machines – Dr.P.N.Modi & S.M.Seth, (Narosa Publishing House)

Name of Reference Books:
1. Mechanics of Fluid – Irving H. Shames (McGraw Hill)
2. Introduction to Fluid Mechanics – James A. Fay (Prentice Hall India)
3. Fluid Mechanics – R.J. Garde (New Age International Publication)
4. Fluid Mechanics – Streeter V.L. & Wylie E.B. (Tata McGraw Hills)
5. Fluid Mechanics – John F Dougles (Pearson Publication)
6. Introduction to Fluid Mechanics Fox, R.W. and Mc Donald, A.T., John Wiley & Sons.
7. Fluid Mechanics", Streeter, V.L. and Benjamin, W.E., "McGraw-Hill.
8. Fluid Mechanics and Fluid Mechanics Som, S.K. and Biswas, G., Tata McGraw Hill.
9. Introduction to Fluid Mechanics, Fox, R. W. and A. T. McDonald, 6th ed., John Wiley, New York, (2004)

Course Outcomes- At the end of the course students will be able to
- To understand the broad principles of fluid statics, kinematics and dynamics
- To understand definitions of the basic terms used in fluid mechanics
- To apply the discharge measurement methods in open channel and pipes.

SYLLAUS	(SEMESTER-III)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject Code:	CE03TPC03	3	0	0	15	15	30			
Subject:	Building Materials & Construction									

Course Learning Objectives:

- To introduce the basic engineering properties of building materials like brick, stones, timber, ceramics, plastics, etc.
- To understand the elementary characteristics of construction materials like cement aggregates, concrete, steel, etc.
- To understand the types of foundations, functions, types of masonry, lintels, etc.
- To learn the structure supporting method like Shoring, Underpinning, and other advanced construction materials & Techniques.

Course Content:

UNIT- 1: Stones, Bricks, Tiles, Timber; Properties, Classification &Uses
UNIT-2: Miscellaneous Engineering Materials; Ceramics & glass; Plastics & Rubber; Paints, Varnishes and distempers; Composite materials; Adhesives; Thermal, Electrical & Sound Insulators.
UNIT 3: Cement, Aggregate, Concrete and Steel; classification, properties & uses.
UNIT-4: Foundations, Masonry, Arches & Lintels; Classification, Requirements & Uses.
UNIT-5: Shoring, Underpinning, Formwork, Advanced construction materials & Techniques.

Name of Text Books:
1. Building Materials – S.K. Duggal (New Age Publication)
2. Building Materials – S. C. Rangwala (Charotar Publication)
3. Building Construction by S.G. Rangwala, Charter Publishing House, Anand, India.
4. Building Construction by Sushil Kumar, Standard Publ. and Distributors, New Delhi
5. Building Construction by Punmia B.C., Lakshmi Publications, New Delhi.
6. Advanced Building Materials and Construction by Mohan Rai and Jai Sing, CBRI Publications, Roorkee
7. Concrete Technology – A.M. Neville & J.J. Brooks (Pearson Education)
8. Concrete Technology – M.S. Shetty (S. Chand & Co.)
9. Engineering Materials – Surendra Singh (Laxmi Publication)
10. Construction Engineering and Management – S. Seetharaman (UmeshPublication)
11. Building Materials – Gurucharan Singh (Standard Publishers, Delhi

Course Outcomes- At the end of the course students will be able
- To compare the properties of most common and advanced building materials.
- To understand the typical and potential applications of these materials
- To select the appropriate building material for building construction
- To identify the different components of a building and differentiate various types of foundations, masonry, arches and lintels
- To select the appropriate supporting structure for strengthening of the building

SYLLAUS	(SEMESTER-III)	Periods / Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject Code:	CE03TPC04	3	0	0	15	15	30			
Subject:	Surveying & Geomatics									

Course Learning Objectives:

- To understand the basic principles of surveying of linear & elevated measurements i.e. chain survey, levelling etc.
- To expertise in surveying instrument like Compasses, theodolite & Total station etc.
- To learn the subsidiary surveying like photographic & hydrographic surveying
- To learn the advanced application of surveying like Remote sensing, EDM

Course Content:

Unit 1: Introduction to Surveying : Definition - Principles - Classification - Scales - Ranging and chaining - Reciprocal ranging .COMPASS SURVEYING: Prismatic compass - Surveyor's compass - Bearing - Systems and conversions - Local attraction – Magnetic declination - Dip .
LEVELLING: Principle of levelling, Different methods of determining elevations. Temporary and permanent adjustment of levels. Sensitivity of bubble tube, Levelling staff, Types of levelling: - Reciprocal, Profile, Differential, Plotting of profiles Correction: - Curvature and refraction.

Unit 2: Theodolite and Traversing: Vernier theodolites, Temporary and permanent adjustments, Requirements of nonadjustable parts, Measurement of horizontal angle by repetition and reiteration method, Measurement of vertical angles.
TACHEOMETERY: Definitions, Principles of stadia systems. Instrument constants, Substance and Tangential Systems. Construction and use of Reduction Tacheometers.
CONTOURING; Introduction to contouring.

Unit 3:.Triangulation: Principle and classification of Triangulation System, Strength of Figures, Station marks and Signals, Satellite station, intersected and Resected points.
.
Plane Table Surveying: Principles, Advantages and disadvantages, Plane table equipment, Use of Telescopic Alidade, Different methods of Plane Table Surveying.

Unit 4: PHOTOGRAPHIC SURVEYING: Photo theodolite, principle of the method of terrestrial photogrammetry, scale and distortion of the vertical and tilted photograph. HYDROGRAPHIC SURVEYING: Introduction, shore line survey, soundings methods

Unit 5: (A) Principle of Electronic Distance Measurement: Principle, Type, Use ,Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories – Advantages and Applications.
(B) Remote Sensing: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors.

Text/Reference Books:
1 Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2 Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3 Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010

Course Outcomes- At the end of the course students will be able to:
- To apply the knowledge, techniques, basics, and instruments of the discipline to engineering and surveying activities
- Explain different methods and their procedure for levelling
- Explain the working principles of various surveying instruments
- To relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.

SYLLAUS	**(SEMESTER-III)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	-	-	00
Subject Code:	CE03THS03	2	0	0						
Subject:	Indian Constitution				-	-	-			

Course Learning Objectives:
- To the importance of preamble of the constitution of India.
- To understand the fundamental rights and duty as a citizen of India.
- To understand the functioning of union and state government and their inter-relationship.

Course Content:
UNIT 1: Introduction: Constitution-meaning of the term, Sources and constitutional theory, Features, Citizenship. Preamble**.**

UNIT 2: Fundamental Rights and Duties: Fundamental Rights, Fundamental Duties, Directive Principles of State Policy

UNIT 3: Union Government: Structure of Indian Union: Federalism, Centre-State relationship President: Role. Power and position, Prime Minister and council of ministers, Cabinet and Central Secretariat, Lok Sabha. Rajya Sabha

UNIT 4: State Government: Governor: Role and position, Chief Minister and council of ministers, State Secretariat

UNIT 5: Relationship between Centre and States: Distribution of Legislative Powers, Administrative Relations, Coordination between States

Text Books:

1. Constitution of India, V.N. Shukla
2. The Constitutional Law of India, J.N. Pandey
3. Indian Constitutional Law. M.P. Jain

Outcome: At the end of the course students will be able to:
- Describe the salient features of the Indian Constitution
- List the Fundamental Rights and Fundamental Duties of Indian citizens
- Describe the Directive Principles of State Policy and their significance

SYLLAUS	(SEMESTER-III)	CREDITS: 3		INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	CE03PPC01	L	T	P	IA	MSE	TOTAL	
Subject:	Surveying Lab	0	0	3	30	-	30	20

		L	T	P	IA	MSE	TOTAL	

Course Learning Objectives:

The Lab sessions would help in learning:
- Application of chains & compass in surveying.
- Various Applications of levelling process.
- Use of Plane table surveying in preparing of maps of a location
- Tacheometery & its Application.
- Relative adjustment of non- accessible stations
- Principle & operation of Total Station.

Course Content:
List of experiments
1. Linear measurement, offsetting & Determination of the area of the given field by cross staff survey & metric chain.
2. Compass open & closed traversing using prismatic compass and elimination of local attraction.
3. To find the difference in elevation between the two non-invisible stations by the method of differential levelling.
4. To draw longitudinal & cross-sectional profile of the road by the method of profile levelling.
5. Measurement of horizontal angle by repetition & reiteration method.
6. Traversing of the given area by radiation & intersection method using plane table survey.
7. Find the plane table instrument station using Resection method (Two point problem & three point problem)
8. Determination of Tacheometric constants (K & C).
9. Determination of elevation and height by tangential method when both angles are angles of elevation.
10. Determination of elevation and distance when line of sight inclined Upward & Downward
11. To perform the experiment for reduction to center from different positions of a satellite station when: (i) Satellite station in north position, (ii) Satellite station in left position
12. To perform the experiment for reduction to centre from different positions of a satellite station when: (i) Satellite station in south position, (ii) Satellite station in right position
13. Study of total station

Text Book:
1. Surveying and Leveling. N.N.Basak, 1st Edition, Tata McGraw Hill
2. Surveying (Vol. I & II) – Punmia, B.C. (Laxmi Publications, New Delhi, 1996)
3. Surveying (Vol. I & II) – Kanetkar (Pune VidyarthiGrihaPrakashan, Pune)

Name of Reference Books:
1. Surveying (Vol. II & III) – Agor, R (Khanna publications, Delhi, 1995)
2. Surveying (Vol. II & III) – Arora, K.R. (Standard Book House, Delhi, 1993)
3. Fundamentals of Surveying – S.K. Roy (Prentice Hall of India)
4. Surveying (Vol. I & II) – S.K. Duggal (Tata McGraw Hill)

Course Outcomes- On completion of the course, the students will be able to:
- Use conventional surveying tools such as chain/tape, compass, plane table, level in the field of civil engineering applications such as structural plotting and highway profiling.
- Apply the procedures involved in field work and to work as a surveying team.
- Plan a survey appropriately with the skill to understand the surroundings.

- Take accurate measurements, field booking, plotting and adjustment of errors can be understood.

SYLLAUS	(SEMESTER-III)	CREDITS: 3		INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	CE03PPC02	L	T	P	IA	MSE	TOTAL	
Subject:	Fluid Mechanics Lab	0	0	3	30	-	30	20

Course Learning Objectives:

- To learn the calibration of discharge measuring, velocity measuring devices in pipes and an open channels.
- To learn the calculation of losses in pipe flow.
- To understand the verification of bernoulli's equation.

Course Content:

List of experiments

1. To calculate the total energy at different points and plot the graph between total energy vs. distance. (Verification of Bernoulli's equation)
2. To determine the Meta centric height with angle of ship model.
3. To determine the co-efficient of Discharge Cd for Venturimeter
4. To determine the co-efficient of Discharge Cd for Orificemeter.
5. To determine the co-efficient of discharge and the co-efficient of velocity for Orifice.
6. To determine the co-efficient of discharge and the co-efficient of velocity for Mouthpiece.
7. To determine the coefficient of discharge Cd of Rectangular Notch.
8. To determine the coefficient of discharge Cd V Notch - 45^0
9. To determine the coefficient of discharge Cd V Notch - 60^0
10. To determine the friction factor for Darcy-Weisbach equation
11. Experimental determination of critical velocity in pipe.
12. To determine the coefficient of impact for vanes
13. To find the co-efficient of pitot tube
14. To plot velocity profile across the cross section of pipe
15. To determine the Reynold's Number in pipe
16. Calibration of rectangular sharp cornered weir and to study the pressure distribution on the upstream face of the weir.
17. Calibration of rectangular streamlined weir and to study the pressure distribution on the upstream face of the weir.

Course Outcomes- At the end of the course students will be able to
- Utilization of basic measurement techniques of fluid mechanics
- Understand the differences among measurement techniques.

SYLLAUS	(SEMESTER-III)	CREDITS: 3			INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	CE03PES06	L	T	P	IA	MSE	TOTAL	
Subject:	Computer Aided Civil Engg.Drawing	0	0	3	30	0	30	20

Course objectives:
- To develop the capability to draw the basic detailed elements of structures like truss, beam, column etc. using Auto CAD
- To develop the capability to draw plan, section of residential building using Auto CAD
- To develop the capability to draw plan, section of public building using Auto CAD

Course Content:
List of Experiments:
1. Basic drawing for symbols used in building drawing
2. Drawing of different Foundation
3. Drawing of different masonry wall
4. Drawing of masonry bonds
5. Drawing of trusses
6. Drawing of retaining Wall
7. Drawing of Stair case, Doors and Windows
8. Plan, elevation and section of Residential Building
9. Plan, elevation and section of Public Building like school, college etc.
10. Detailing of beam, column and slab

Text Books / References:
1. N Krishna Raju, Structural Design and Drawing, Second Edition, Universities Press (India), Private Limited, Hyderabad, 2009
2. AutoCAD Essentials, Autodesk official Press, John Wiley & Sons, US, 2015

Outcomes: At the end of the course students will be able to:

- To draw planning and detailing of residential building with the help of Auto CAD software
- To draw other Civil Engineering structures with the help of Auto CAD software

SYLLAUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE04THS04	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	Engineering Economics	3	0	0	15	15	30			

Course Learning Objectives:
To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions

Course Content:
 UNIT 1: Introduction to Economics

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT 2: Value Engineering
Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factorequal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT 3: Cash Flow
Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT 4: Replacement and Maintenance Analysis
Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT 5: Depreciation
Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation- Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TEXT BOOKS:
1. Panneer Selvam, R, ―Engineering Economics‖, Prentice Hall of India Ltd, New Delhi, 2001.
2. Suma Damodaran, ― Managerial economics‖, Oxford university press 2006.
REFERENCES:
1. Chan S.Park, ―Contemporary Engineering Economics‖, Prentice Hall of India, 2002.
2. Donald.G. Newman, Jerome.P.Lavelle, ―Engineering Economics and analysis‖ Engg. Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, ―Engineering Economy‖, Macmillan, New York, 1984
4. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, ―Principles of Engineering Economy‖, Ronald Press, New York,1976.
5. Smith, G.W., ―Engineering Economy‖, Lowa State Press, Iowa, 1973.
6. Truett & Truett, ― Managerial economics- Analysis, problems & cases ― Wiley India 8 Th edition 2004.
7. Luke M Froeb / Brian T Mccann, ― Managerail Economics – A problem solving approach‖ Thomson learning 2007.

Outcome: At the end of the course students will be able
* To understand the basic economic principles of wants, scarcity, choice, opportunity cost; etc has applied to business organizations and engineering firms. Understand the time value of money and how to sketch the cash flow diagram.

SYLLAUS	**(SEMESTER-IV)**	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject Code:	CE04TPC05									
Subject:	**Concrete Technology**	3	0	0	15	15	30			

Course Learning Objectives:
- To learn about various ingredients materials of concrete, like cement aggregates, water, etc
- To learn about various admixtures that enhances the properties of concrete.
- To learn about various properties of concrete, its design mix
- To study about various types of special concrete

Course Content:

Unit 1: Constituent Material
Cement-Different types-Chemical composition and Properties -Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS grading requirements- Water- Quality of water for use in concrete.

Unit 2: Chemical and Mineral Admixtures
Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers – Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaolin -Their effects on concrete properties

Unit 3: Proportioning of Concrete Mix
Principles of Mix Proportioning-Properties of concrete related to Mix Design Physical properties of materials required for Mix Design – Design Mix and Nominal Mix-BIS Method of Mix Design – Mix Design Examples

Unit 4: Fresh and Hardened Properties of Concrete:
Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS – Properties of Hardened concrete-Determination of Compressive and Flexural strength-Stress-strain curve for concrete Determination of Young's Modulus.

Unit 5: Special Concretes:
Light weight concretes – High strength concrete – Fibre reinforced concrete – Ferrocement – Ready mix concrete – Slurry infiltrated fibrous concrete (IFCON) - Shotcrete – Polymer concrete – High performance concrete- Geopolymer Concrete.

Text Books:
1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003
3. Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007
4. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
5. Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
6. IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998

Outcomes: At the end of the course students will be able to:
- Understand properties and role of ingredients like cement, aggregate, admixtures etc. to produce better quality concrete
- Select the appropriate admixture for better performance of the concrete

- Design the concrete mix by IS Method
- Perform destructive, semi-destructive and non-destructive tests for concrete
- Differentiate between normal concrete and other special concretes
- Demonstrate advancements in concreting materials and techniques

SYLLAUS	**(SEMESTER-IV)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE04THS05	L	T	P	CT-1	CT-II	TOTAL	70	100	02
Subject:	Professional Practice, Law & Ethics	2	0	0	15	15	30			

Course Learning Objectives
- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession.

Course Content

UNIT 1: Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards). Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

UNIT 2: General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Term.

UNIT 3: Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court

assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

UNIT 4: Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

UNIT 5: Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. The National Building Code, BIS, 2017
3. RERA Act, 2017
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Neelima Chandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R. (1979), Law of Contract, Oxford University Press
9. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
11. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
12. Bare text (2005), Right to Information Act
13. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
14. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
15. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
16. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2,pp 117-127, MCB UP Ltd
17. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
18. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
19. Engineering Ethics, National Institute for Engineering Ethics, USA
20. www.ieindia.org
21. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
22. CONSTRUCTION CONTRACTS, http://www.jnormanstark.com/contract.htm
23. Internet and Business Handbook, Chap 4, CONTRACTS LAW, http://www.laderapress.com/laderapress/contractslaw1.html
24. Contract&Agreements

http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm
25. Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt
26. Business & Personal Law. Chapter 7. "How Contracts Arise",
http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
27. Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
28. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS,
http://www.worldbank.org/html/opr/consult/guidetxt/types.html
29. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02),
http://www.sandia.gov/policy/14g.pdf

Course Outcome
At the end of the course student will be able to
- To familiarise the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession
- To give a good insight into contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labour
- To give an understanding of Intellectual Property Rights, Patents.
- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop good ideas of the legal and practical aspects of their profession

SYLLAUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-1	CT-II	TOTAL			
Subject Code:	CE04TPC06	3	1	0	15	15	30	70	100	04
Subject:	Structural Analysis-I									

Course Learning Objectives
- To study about the strain energy principles and their applications to beams and pin joint plane frames
- To learn about analysis of arches &cables.
- To learn how to draw influence line diagrams for beams and arches
- To study about the maximum SF, BM and absolute max BM
- To learn about the static and kinematic indeterminacy of structures and methods of analysis, analysis of fixed and continuous beams

Course Content:

UNIT-1: Principle of superposition, virtual work principle, Maxwell reciprocal theorem, deflection of beams using conjugate beam method. Deflection of beams and truss using energy method (Castigiliano theorem), Analysis of plane truss using tension coefficient method (determinate)

UNIT-2: Three-hinged Arches: Bending Moment, Shear force, axial force for three-hinged arches, Analysis of Suspension Bridge without stiffening girders.

UNIT-3: Influence Lines: Basic concept of moving load and influence line; influence lines for reactions, Shearing for.es and bending moments for determinate beams; absolute maximum shearing force and bending moment.

UNIT-4: Influence lines for three-hinged arches and stresses in simply supported plane determinate trusses

UNIT-5: Static and kinematic indeterminacy of structure, Method of structural analysis, Analysis of fixed beam, continuous beam using Theorem of three moments Effect of yielding of supports.

Reference Book:
1. Elementary structural Analysis by A.K. Jain
2. Advanced Structural Analysis by A. K. Jain

Outcome: At the end of the course students will be able
- To explain the concept of strain energy and analyse the determinate beams and trusses
- To able to analysis three hinged arches.
- To apply and analyse the concept of influence lines for deciding the critical forces and sections while designing
- Classify & discuss statically determinate & indeterminate structures, to find out the static and kinematic indeterminacy of the structure,
- To differentiate the force and displacement methods.
- To analysis the fixed and continuous beams by using theorem of three moments
- To understand the effect of temperature, yielding of supports in indeterminate structures

SYLLAUS	**(SEMESTER-IV)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE04TPC07	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	Fluid Mechanics-II	3	0	0	15	15	30			

Course Learning Objectives:
- To study the different flows in pipe like turbulent, and non-uniform flow in open channel.
- To study the effect of boundary layer against the flow.
- To understand the dimensional analysis in model and prototype.
- To study the hydraulic machines like turbine and pumps.

Course Content:
UNIT-1: Turbulent flow in pipe: Nature of turbulence, free and wall turbulence, turbulent flow in pipes, equation for velocity distribution over smooth and rough surfaces, Colebrook-White equation, Moody's diagram, Explicit equation for friction factors.

UNIT -2: Boundary layer Analysis: Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, turbulent boundary layer, and laminar sub layer, Application of momentum equation, local and average friction coefficient. Fluid flow past submerged bodies. Drag and lift, drag on sphere and cylinder Magnus effect.

UNIT-3: Non-uniform flow in open channel: Specific energy, critical flow, analysis of flow over hump and transition, equation of gradually varied flow, hydraulic jump and evaluation of its elements in rectangular channel.

UNIT-4: Compressibility effect in pipe flow: Transmission of pressure waves in rigid and elastic pipes, water hammer Dimensional analysis and Hydraulic similitude. Dimensional analysis, Buckingham's theorem, important dimensionless numbers and their significances, geometric, kinematics and dynamic similarity, model study.

UNIT-5: Hydraulic Machines: Turbines: Classification of turbines, draft tube, specific speed, unit quantities, and characteristics curves of turbines, and governing of turbine. Pump: Introduction, Centrifugal pumps, efficiencies, specific speed, cavitations, slip, percentage slip.

Name of Text Books:

1. Fluid Mechanics and Machines – Dr. A.K. Jain (Khanna Publications)
2. Fluid Mechanics and Machines – Dr. R.K. Bansal (Laxmi Publications)
3. Fluid Mechanics – Dr. P.N. Modi (Standard Book House)
4. Mechanics of Fluid – Irving H. Shames (McGraw Hill)
5. Introduction to Fluid Mechanics – James A. Fay (Prentice Hall India)

Name of Reference Books:
1. Fluid Machines – Dr.JagdishLal (Metropolitan Book Company Private Ltd.)
2. Fluid Machines – John P. Douglas (Pearson Publication)

Outcome: At the end of the course students will be able to
- To understand the difference between broad principles of flow of fluid, for instance laminar and turbulent flow.
- To understand boundary layer effect and importance of dimensional analysis in design of stream lined object.
- To understand the functioning of turbines and pipes.

SYLLAUS	(SEMESTER-IV)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE04THS06	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	Effective Technical Communication	3	0	0	15	15	30			

Course Learning Objectives:

Effective Technical communication is critical in today's world. Most problems in an organization arise as a result of poor communication. Effective communication ensures a smooth flow of ideas, facts, decisions, and advice. This way, employees eliminate hindrances in achieving the organization's target.

Course Content:

Unit-1 Fundamentals of Communication Technical Communication: features: Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communications; the flow of Communication: Downward, Upward, Lateral of Horizontal (Peer group): Importance of technical communication; Barriers to Communication.

Unit-2 Constituents of Technical Written Communication Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation-various steps.

Unit-3 Business Communication Principles, Sales & Credit letters; Claim and Adjustment Letters; Job application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance. Negotiation & Business Presentation skills.

Unit-4 Presentation Strategies and Listening Skills. Defining Purpose; Audience & Local; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Listening Skills: Active Listening, Passive Listening. methods for improving Listening Skills.

Unit-5 Value-Based Text Readings Following essays form the suggested text book with emphasis on Mechanics of writing. (i) Humanistic and Scientific Approaches to Human Activity by Moody E. Prior (ii) The Language of Literature and Science by A. Huxley (iii) Man and Nature by J.Bronowski (iv) The Social Function of Literature by Ian Watt (v) Science and Survival by Barry Commoner (vi) The Mother of the Sciences by A.J.Bahm (vii) The Effect of Scientific Temper on Man by Bertrand Russell.

Text Book :
1. Improve Your Writing ed. V.N.Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi..
 2. Technical Communication: A Practical Approach: Madhu Rani and Seema Verma- Acme Learning, New Delhi-2011
3. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press,2007, New Delhi.

Reference Books:
1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt.Ltd,2011, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C.Sharma & Krishna Mohan, Tata McGraw Hill & Co.Ltd.,2001, New Delhi.
3. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. &Distributors, 2009,Delhi.
4. Developing Communication Skills by Krishna Mohan, Mecra Bannerji- Macmillan India Ltd. 1990, Delhi.
5. Manual of Practical Communication by L.U.B.Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
6. English Grammar and Usage by R.P.Sinha,

Course Outcomes:
- At the end of the semester, employability skills of the students will develop.
- Students will improve their Vocabulary and their Accent.

SYLLAUS	(SEMESTER-IV)	CREDITS: 1			INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	CE04PHS01	L	T	P	IA	MSE	TOTAL	
Subject:	Effective Technical Communication Lab	0	0	2	30	-	30	20

Course Learning Objectives:

Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (I.P.A.)

Course Content:

LIST OF PRACTICALS:

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
 2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
 3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics/ Kinesics.
 4. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
 5. Official/Public Speaking based on suitable Rhythmic Patterns.
6. Theme- Presentation/ Key-Note Presentation based on correct argumentation methodologies.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practicals on a model Audio-Visual Usage.

Reference Books:
1. Bansal R.K. & Harrison: Phonetics in English, Orient Longman, New Delhi.
2. Sethi & Dhamija: A Course in Phonetics and Spoken English, Prentice Hall, New Delhi.
 3. L.U.B.Pandey & R.P.Singh, A Manual of Practical Communication, A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi.
4. Joans Daniel, English Pronouncing Dictionary, Cambridge Univ. Press.

Course Outcomes: On completion of the course, the students would be able to:
- Improve interpersonal communication
- Overcome stage fright and enhance confidence
- Participate in GDs
- Master presentation Skills and Interview Skills
- Learn and practice Listening, Reading, Writing and Speaking Skills

SYLLAUS	**(SEMESTER-IV)**	CREDITS: 3		INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	**CE04PPC03**	L	T	P	IA	MSE	TOTAL	
Subject:	Material testing lab	0	0	3	30	0	30	20

Course Learning Objectives:

- To learn to perform various experiments related to properties of Cement.
- To learn to perform various experiments related to properties of Aggregates.
- To learn to perform various experiments related to properties of Bricks.
- To learn to perform various Destructive & non –destructive tests on concrete.

Course Content:

List of experiments

Testing of cement

1. Normal Consistency, Fineness of Cement, Setting times of Cement
2. Specific Gravity of Cement
3. Soundness of Cement
4. Compressive strength of cement

Testing of aggregate

5. Fineness modulus of Fine and Coarse aggregate
6. Bulk density of aggregate
7. Specific Gravity and Water Absorption of Aggregate
8. Bulking of Sand

Testing of bricks

9. Compressive strength, Water Absorption &Efflorescence of Bricks

Testing of concrete

10. Workability of Concrete
11. Compressive strength
12. Modulus of Elasticity
13. Tensile Strength of Concrete
14. NDT Test of Concrete

Outcomes: At the end of the course students will be able
- The students will have acquired the knowledge in the area of testing of construction materials.
- By knowing the properties of materials, it will be possible to design concrete mix that will be of desired properties