NEW HORIZON
COLLEGE OF ENGINEERING
Permanently affiliated to VTU, approved by AICTE & ISO 9001:2008 certified
The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Government of Karnataka
Awarded Outstanding Technical Education Institute in Karnataka-2014
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(An Autonomous Institution Affiliated to VTU)

Accredited by NAAC with 'A' Grade

Department of Civil Engineering

Academic Year 2016-17

Third and Fourth Semesters B.E

Scheme and Syllabus

CONTENTS

VISION

Vision of the Civil Engineering Department is to be a world class academic centre for quality education and research in diverse areas of civil engineering with a strong social commitment.

MISSION

- To make them turnout to be competent professionals with ethical and moral values.
- To make them contribute towards the overall development of community by honouring social commitments.
- To make them develop into effective, efficient and responsible civil engineers.
- To make them engage in academic & research activities and entrepreneurial endeavours.

Program Education objectives (PEOs)

PEO1	Graduates will be able to conceptualize, analyze, design and propose a feasible solution to civil Engineering problems by applying basic principles of Mathematics, Science, Engineering, Sustainable development and Socio-Eco-friendly environment.
PEO2	Graduates will be inculcated with necessary professional skills, ethics, commitment, communication skills, leadership quality and holistic personality traits to become efficient and effective engineers.
PEO3	Graduates will be able to work as a team in intra and interdisciplinary endeavours for development of new ideas and products for the betterment of society by pursuing career paths in teaching, research and entrepreneurship.
PEO4	Graduates will be able to face challenges of the world economic order by incorporating expertise involving modern tools and techniques in the field of infrastructural development

PEO to Mission Statement Mapping

Mission Statements	**PEO1**	**PEO2**	**PEO3**	**PEO4**
To make them turnout to be competent professionals with ethical and moral values.	3	3	2	2
To make them contribute towards the overall development of community by honouring social commitments.	3	3	3	1
To make them develop into effective, efficient and responsible civil engineers.	3	3	3	3
To make them engage in academic & research activities and entrepreneurial endeavours	2	1	3	2

Correlation: 3- High, 2-Medium, 1-Low

Program Outcomes (PO) with Graduate Attributes

	Graduate Attributes	Program Outcomes (POs)
1	Engineering Knowledge	**PO1:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex civil engineering problems.
2	Problem analysis	**PO2:** Identity, formulate, research literature and analyze complex civil engineering problems reaching substantiated conclusion using first principles of mathematics and engineering sciences.
3	Design and Development of Solutions	**PO3:** The ability to analyse complexities of various civil engineering elements and design similar such elements.
4	Investigation of Problem	**PO4:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information related to civil engineering problems to provide valid conclusions.
5	Modern Tool usage	**PO5:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex civil engineering activities with an understanding of the limitations.
6	Engineer and society	**PO6:** Apply reasoning based on the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the civil engineering professional practice.
7	Environment and sustainability	**PO7:** Understand the impact of the civil engineering solutions in societal and environmental contexts and demonstrate the knowledge of need for sustainable development.
8	Ethics	**PO8:** Apply ethical principles, commit to professional ethics, own up responsibilities and abide by the norms of the civil engineering practice.
9	Individual & team work	**PO9:** As a civil engineer function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	**PO10:** Communicate effectively on complex civil engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Lifelong learning	**PO11:** Recognize the need for, willingness to prepare for and to exhibit pro-activeness to engage in independent and lifelong learning in the broadest context of technological change with respect to civil engineering field.
12	Project management and finance	**PO12:** Demonstrate knowledge and understanding of the civil engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments as a civil engineer.

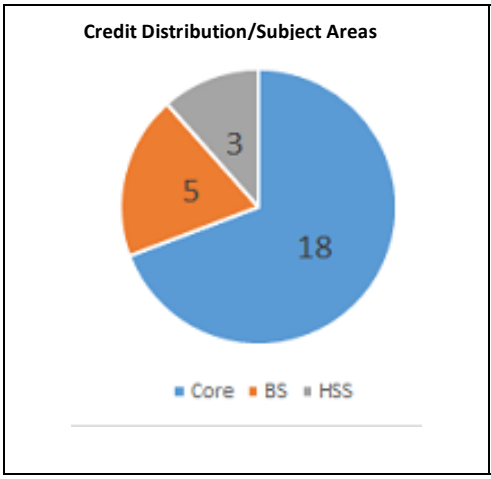
Mapping of POs TO PEOs

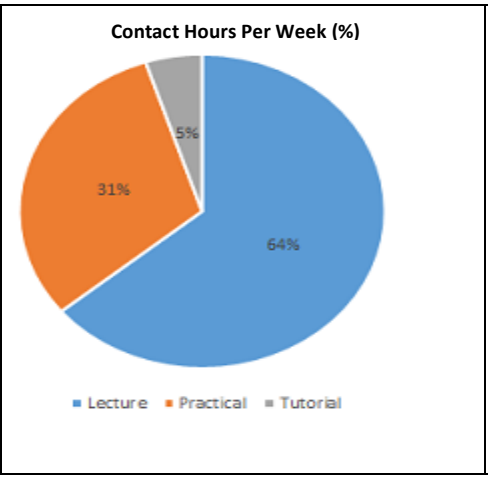
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	3	2	1	1	2	2	2	2	2
PEO2	2	2	2	2	3	3	1	3	2	2	2	2
PEO3	1	2	2	2	2	3	3	3	2	2	3	3
PEO4	3	3	2	3	2	2	2	2	1	1	2	3

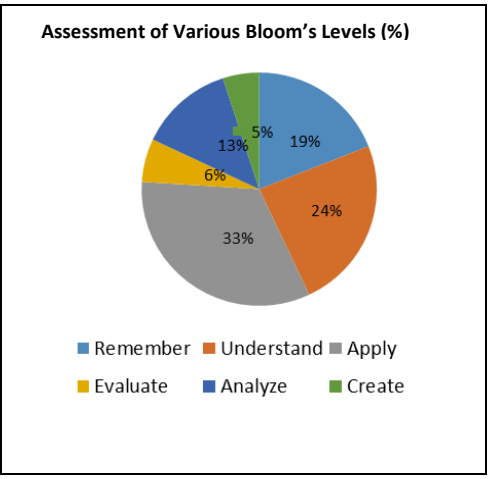
Correlation: 3- High, 2-Medium, 1-Low

New Horizon College of Engineering
Department of Civil Engineering
Scheme of Third Semester B.E Program

Sl. No	Course Code	Course	Credit Distribution				Overall Credits	Contact Hours weekly - Theory	Contact Hours weekly- (Lab)	Marks		
			L	P	T	S				CIE	SEE	Total
1	16MAT31	Engineering Mathematics-III	4	0	2	0	5	6	0	50	50	100
2	16HSS321	Introduction to Economics	2	0	0	1	3	2	0	50	50	100
	16HSS322	Soft Skills for Engineers										
3	16CIV33	Building Materials & Construction	3	0	0	1	4	4	0	50	50	100
4	16CIV34	Strength of Materials	3	2	0	0	5	5	4	75	75	150
5	16CIV35	Plane Surveying	2	2	0	0	4	4	4	75	75	150
6	16CIV36	Mechanics of fluids	3	2	0	0	5	5	4	75	75	150
Total							**26**	**26**	**12**	**375**	**375**	**750**

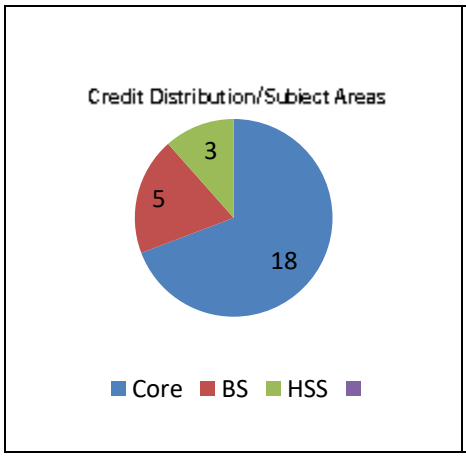


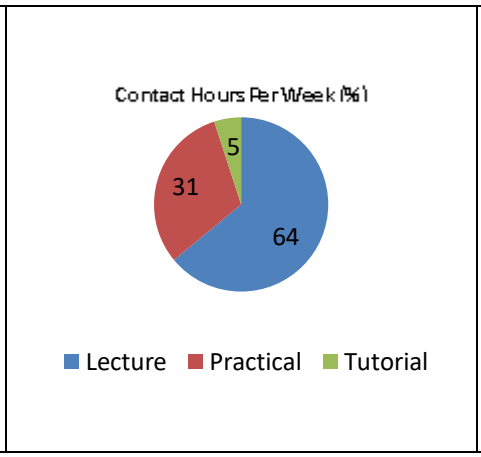


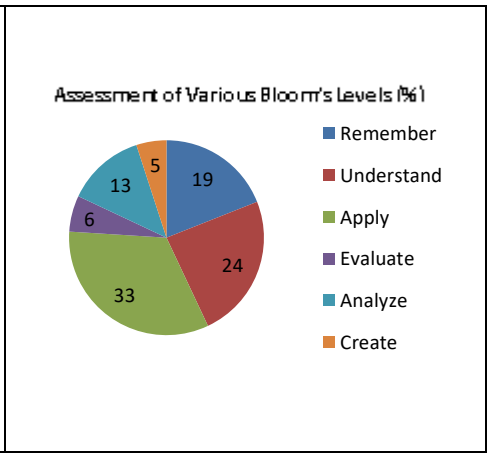


New Horizon College of Engineering
Department of Civil Engineering
Scheme of Fourth Semester B.E Program

Sl. No	Course Code	Course	Credit Distribution				Overall Credits	Contact Hours weekly Theory	Contact Hours weekly (Lab)	Marks		
			L	P	T	S				CIE	SEE	Total
1	16 MAT41	Engineering Mathematics-IV	4	0	1	0	5	5	0	50	50	100
2	16HSS421	Introduction to Economics	2	0	0	1	3	2	0	50	50	100
	16HSS422	Soft Skills for Engineers										
3	16CIV43	Earth Science Engineering	3	0	0	0	3	4	0	50	50	100
4	16CIV44	Analysis of determinate structures	3	0	0	0	3	5	0	50	50	100
5	16CIV45	Higher Surveying	3	2	0	0	5	4	4	75	75	150
6	16CIV46	Applied Hydraulics and Machinery	3	2	0	0	5	5	4	75	75	150
7	16CIV47	Building Planning and Drawing	0	2	0	0	2	0	4	25	25	50
Total							**26**	**25**	**12**	**375**	**375**	**750**







ENGINEERING MATHEMATICS – III
(Common to All Branches)

Course Code : 16MAT31 **Credits : 05**
L:P:T:S : 4:0:1:0 **CIE Marks : 50**
Exam Hours : 03 **SEE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Solve the Fourier series expansion of a functions analytically and numerically
CO2	Solve the Continuous model problems using Fourier transforms
CO3	Solve the discrete model problems using Z-transforms and Fast Fourier transform
CO4	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data
CO5	Use appropriate numerical methods to solve algebraic and transcendental equations and also Evaluate a definite integral numerically
CO6	Use appropriate numerical methods to solve Boundary Value Problems in Partial differential equations

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	1	1	1	-	-	-	2	1	-	2
CO2	3	3	1	1	1	-	-	-	1	1	-	2
CO3	3	3	2	3	3	-	-	-	2	1	-	2
CO4	2	3	2	2	2	-	-	-	1	3	-	1
CO5	2	2	3	3	2	-	-	-	1	2	-	1
CO6	3	3	3	2	3	-	-	-	2	1	-	1

Syllabus			
Module	**Contents of the Module**	**Hours**	**Cos**
1	**Fourier series:** Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period $2l$, half range series. Fourier series and half Range Fourier series of periodic square wave, half wave rectifier, full wave rectifier, Saw-tooth wave with graphical representation, practical harmonic analysis.	**9**	**CO1**
2	**Fourier Transforms:** Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse Fourier transform. **Z - Transform**: Definition, Z-transforms of some standard functions , properties, damping rule, shifting rule(without proof), initial and final value theorems, inverse Z- transforms. **Applications:** Solving difference equations using Z-transform.	**9**	**CO2, CO3**
3	**Statistical Methods:** Fitting of the curves of the form $y = a + bx$, $y = a + bx + cx^2$, $y = ae^{bx}$, $y = ax^b$, and $y = ab^x$ by the method of least square**,** Correlation and Regression , Regression coefficients, line of regression – problems. **Discrete Fourier Transform and Fast Fourier Transform**: Definition of N-Point DFT, problems for 4-Points and inverse DFT for four points only. FFT algorithm to compute the Fourier transforms 4-Point only.	**9**	**CO3, CO4**
4	**Numerical Methods-1:** Numerical solution of algebraic and transcendental equations; Rugula- falsi method and Newton Raphson's method. Solution of a system of equations using Gauss-seidel and Relaxation method. Interpolation & extrapolation – Newton's forward and backward formulae for equal intervals, Newton divided difference and Lagrange's formulae for unequal intervals.	**9**	**CO5**

5	**Numerical Methods-2**: Numerical integration - Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule, Weddle's rule (without proof)-Problems. Numerical solution of Boundary value problems-Solution of one dimensional wave equation and heat equation, Numerical solution of two dimensional Laplace's equation and Poisson's equation.	**9**	**CO5, CO6**

Text Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 10^{th} edition,2014, Wiley-India publishers.

2. Higher Engineering Mathematics, B.S.Grewal, 43^{nd} edition, 2014, Khanna Publishers .

Reference Books:

1. Advanced Modern Engineering Mathematics, Glyn James, 4^{th} edition, 2015, Pearson Education.
2. Advanced Engineering Mathematics, Dennis G. Zill, Michael R. Cullen, 4^{th} edition, 2015, Jones and Barlett Publishers Inc.
3. Engineering Mathematics, B. V. Ramana, 4^{th} edition, 2005, Tata McGraw Hill Publications.
4. Engineering Mathematics, Anthony Craft, 4^{th} edition, 2013, Pearson Education.

Assessment Pattern

1. CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests (30 Marks)**	**Assignments (10 Marks)**	**Quizzes (10 Marks)**
Remember	10	3	5
Understand	5	5	5
Apply	5	2	-
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

2. SEE- Semester End Examination (50 Marks)

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

BUILDING MATERIALS AND CONSTRUCTION

Course Code : 16CIV33 **Credits: 04**

L: P: T: S : 3:0:0:1 **CIE Marks : 50**

Exam Hours : 3 **SEE Marks : 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Impart understanding of various elements of structure and their specifications.
CO2	Identify different types of construction materials.
CO3	Determine the properties of various construction materials.
CO4	Study types of masonry, roofing & flooring system, doors and windows.
CO5	Study types of stairs and design of dog legged staircase as per code.
CO6	Impart understanding of form work for construction and repairing.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
CO1	2	1	1	-	2	-	1	-	-	1	3	-
CO2	1	2	-	-	2	-	1	-	-	2	3	-
CO3	2	2	-	-	2	-	1	-	-	2	3	-
CO4	2	2	2	1	2	2	3	-	-	2	3	-
CO5	2	2	2	1	3	2	3	-	-	2	3	-
CO6	2	2	2	1	2	2	3	-	-	2	3	-

Module No	Content of Module	Hrs	COs
1	**INTRODUCTION TO BUILDING CONSTRUCTION**: Definition, Types of Building as per National Building Code, Components of building, Requirement of parts of building, Types of loads. **FOUNDATION:** Foundation, Foundation Types (Shallow/Deep) And Their Suitability, Failure of Foundation and Its Causes, Site Exploration, purpose of site exploration	09	CO1
2	**STONES:** types of rocks, Requirements of good structural stone, Properties and uses of principal building stones **BRICKS:** Constituents of good brick earth, Manufacturing process of bricks, Testing of bricks	09	

	CONCRETE BLOCKS: Introduction, types of blocks. **PAVERS:** Introduction, types and uses. **OTHER MATERIALS:** Timber: Properties and defects in timber**,** seasoning and advantages of seasoning. Properties, types and uses of following materials- Paints and Varnishes, Steel, Glass, fire resistant materials		CO1,CO2 & CO3
3	**MASONRY:** Introduction, Various terms used, Classification of masonry. **STONE MASONRY**- Classifications of stone masonry: Rubble masonry, Ashlars masonry, Dressing of stones. **BRICK MASONRY**-Types of bricks, Bonds in brick work, Laying brick work, Introduction to load bearing , cavity and partition walls, Reinforced brick work	09	CO1 & CO4
4	**ROOFS AND FLOORS:** Types of roofs, Various terms used, Types of pitched roofs -King post truss, Queen post truss, Roofing Materials, Various types of floorings: timber flooring, cement concrete flooring, mosaic flooring, ceramic flooring, tile flooring RCC flooring. Industrial flooring. **DOORS AND WINDOWS:** Technical terms used, Locations of doors and windows. Types of Doors: glazed or sash doors, flush doors, louvered doors, collapsible doors, revolving doors, rolling steel doors, sliding doors, and swing doors. Types of Windows: Casement Window, Double Hung Window, Pivoted Window, Sliding Windows, Louvered Window, Metal Window, Sash Or Glazed Window, Bay Window, Corner Window, Dormer Window, Gable Window, Skylight Window, Circular Window, Fixtures And Fasteners For Doors And Windows.	09	CO1, CO4 & CO5
5	**STAIRS:** Definition of technical terms, Requirements of good stair, Types of Stairs, Geometrical design of RCC Dog legged (Plan and sectional elevation).	09	CO1,

	ARCHES, LINTEL AND BALCONY: "Elements of an arch, Classification of arches, Definition and classification of Lintels, Definition and functions of Chejja, Canopy & Balcony **MISCELLANEOUS** :Form work, scaffolding, shoring and underpinning, thermal insulation, Sound proof, water proofing and termite treatment techniques.		CO5 CO6

Text Books:

1. Building Construction by Sushil Kumar, Standard Publishers, New Delhi, 20th Edition 2015 (ISBN13 - 9788180141683)
2. Engineering Materials by S.*R. Rangwala,* Charotar Publications, Anand,2015. (ISBN10 - 9380358792)
3. Building Construction by B.C. Punmia, Laxmi Publications Pvt. Ltd, New Delhi. 10th Edition 2015 (ISBN10 - 8131804283)

Reference Books:

1. Building Construction by S. P. Bindra and S. P. Arora, Dhanpat Rai and Sons, New Delhi Edition 2015(ISBN 10 – 8189928805)
2. Civil Engineering Materials by Neil Jackson & Ravindra K. Dhir Palgrave Macmillan, Bangalore, 2014 (**ISBN-13:** 9780333636831)
3. Building Materials by S. K. Duggal by New Age International Publishers, New Delhi 4th Edition 2010(**ISBN-13:** 9788122433791)

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Self Study
Marks (out of 50)	**30**	**10**	**10**
Remember	5	-	5
Understand	5	-	5

Apply	5	5	-
Analyze	5	-	-
Evaluate	5	-	-
Create	5	5	-

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	5
Understand	10
Apply	10
Analyze	10
Evaluate	5
Create	10

STRENGTH OF MATERIALS

Course Code : 16CIV34 **Credits : 5**

L: P: T: S : 3:2:0:0 **CIE Marks : 50+25**

Exam Hours : 03 +03 **SEE Marks : 50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials
CO2	Ability to draw BMD and SFD for different beams under different loading conditions
CO3	Compute bending and shearing stresses of beams and torsional stress of circular shafts
CO4	Compute the deflection of beams under different loading conditions
CO5	Calculate the column critical load and stress
CO6	Apply the knowledge of strength of materials on engineering applications and design problems.

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	3	2	1	2	-	-	1	1	-
CO2	3	3	2	2	2	2	1	-	-	1	1	-
CO3	3	2	3	3	2	1	1	-	-	1	2	-
CO4	2	3	3	3	3	2	2	-	-	1	2	-
CO5	3	3	3	2	2	3	2	-	-	1	1	-
CO6	3	2	3	3	2	1	1	-	-	1	1	-

Module No	**Content of Module**	**Hrs**	**COs**
1	**SIMPLE STRESS AND STRAIN** Introduction, Properties of Materials, Stress, Strain, Hook's law, Poisson's Ratio, Stress – Strain Diagram for structural steel and non ferrous materials, Principles of superposition, Total elongation of tapering bars of circular and rectangular cross sections. Elongation due to self – weight. **ELASTIC CONSTANTS AND THERMAL STRESSES** Composite section, Volumetric strain, expression for volumetric strain,	09	CO1

	Elastic constants, relationship among elastic constants, Thermal stresses-simple problems.		
	List of Experiments 1. Tension Test on Mild steel and HYSD bars 2. Compression test of Mild steel, Cast iron and Wood 3. Impact Test on Mild Steel (Charpy & Izod)	08	
2	**BENDING MOMENT AND SHEAR FORCE** Introduction, Types of beams loadings and supports, Shearing force in beam, Bending moment, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, SFD and BMD with salient values for, simply supported beams and considering point loads, UDL, UVL and Couple. SFD and BMD with salient values for cantilever beams, and overhanging beams considering point loads, UDL, UVL and Couple	09	CO2, CO6
	List of Experiments 1. Shear test on Mild Steel 2. Hardness tests on ferrous and non-ferrous metals- Brinell's Rockwell and Vicker's	08	
3	**BENDING STRESS IN BEAMS** Introduction – Bending stress in beam, Assumptions in simple bending theory, Pure bending derivation of Bernoulli's equation, Modulus of rupture, section modulus, Flexural rigidity. **SHEAR STRESS IN BEAMS** Expression for horizontal shear stress in beam Shear stress diagram for rectangular, symmetrical 'I' and 'T' section (Flitched beams not included).	09	CO3
	List of Experiments 1. Bending test on Wood under two point loading 2. Test on Bricks and Tiles	08	

4	**TORSION OF CIRCULAR SHAFTS** Introduction – Pure torsion-torsion equation of circular shafts, Strength and stiffness, Torsional rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections. **THIN AND THICK CYLINDERS**: Stresses in thin cylinder subjected to pressure, hoop, longitudinal and volumetric strains, Thick cylinders-Lame's equations, radial and hoop stresses (excluding compound cylinders)	09	CO3, CO4
	List of Experiments 1. Torsion Test on Mild steel Circular sections 2. Demonstration of strain gauges and strain indicators	08	
5	**COLUMNS AND STRUTS** Introduction – Short and long columns, Euler's theory on columns, Effective length slenderness ration, radius of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for different end conditions, Limitations of Euler's theory, Rankine's formula and problems. **COMPOUND STRESSES (SIMPLE PROBLEMS)** Introduction, Stress components on inclined planes, General two dimensional stress system, Principal planes and stresses.	09	CO5, CO6
	List of Experiments 1. Tests on Fine aggregates – Moisture content, Specific gravity, bulk density, Sieve analysis and Bulking 2. Tests on Coarse aggregate – Absorption, Moisture content, Specific gravity, bulk density and Sieve analysis.		

TEXT BOOKS:

1. "Mechanics of Materials", Punmia .B.C, Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi , (ISBN: 9788131806463) Edition: Revised, 2016
2. "Strength of Materials", Bansal, R.K., Laxmi Publications, (ISBN: 9788131808146), 6th Edition, 2015.
3. Building And Construction Materials: Testing And Quality Control (Lab Manual Series), M.L. Gambhir ISBN 13: 9781259029660

REFERENCE BOOKS:

1. "Elements of Strength of Materials", Timoshenko and Young, Affiliated East-West Press, 5th Edition, 2010
2. "Strength of Materials", Chakarborty, S K Kataria and Sons, (ISBN:978-93-5014-375-9), 2nd Edition, 2001.
3. "Strength of Materials", Ramamrutham. S., New Delhi Dhanpat Rai and Sons, (ISBN: 978-93-84378-26-4), 2015.

CIE- Continuous Internal Evaluation 50 Marks (Theory)

Bloom's Category	**Tests**	**Assignments**	**Quizzes**
Marks	30	10	10
Remember	2	1	2
Understand	8	2	3
Apply	10	5	2
Analyze	10	2	3
Evaluate	-	-	-
Create	-	-	-

CIE- Continuous Internal Evaluation 25 Marks (Practical)

Bloom's Category	**Marks**
Marks	25
Remember	5

Understand	10
Apply	5
Analyze	5
Evaluate	-
Create	-

SEE – Semester End Examination (Theory 50 Marks)

Bloom's Category	**Marks**
Remember	5
Understand	15
Apply	15
Analyze	15
Evaluate	-
Create	-

SEE – Semester End Examination (Practical -25 Marks)

Bloom's Category	**Marks**
Remember	5
Understand	10
Apply	5
Analyze	5
Evaluate	-
Create	-

PLANE SURVEYING

Course Code : 16CIV35 **Credits : 04**

L:P:T:S : 2:2:0:0 **CIE Marks : 50+25**

Exam Hours. : 03+03 **SEE Marks : 50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the basic principles of surveying and types of surveying and importance of surveying instruments.
CO2	Understand the necessity for data collection of earth works, preparation of maps, property boundaries, alignments of railways, roads and innumerable other applications of the surveying practice.
CO3	Acquaint with methodology and various surveying instruments to execute the various surveying projects as required by the construction industries.
CO4	Prepare drawings of property maps, city maps and other related maps.
CO5	Prepare formation levels for the roads, railways and in the laying of the sewerage line at a given gradient by using leveling and contouring.
CO6	Acquaint with the horizontal and vertical components of measurements as required by the present day construction industry.

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**POI0**	**POII**	**PO12**
CO1	3	2	-	-	-	-	-	2	2	2	3	-
CO2	3	3	1	-	-	2	-	2	2	2	2	-
CO3	2	1	-	-	2	2	-	2	2	2	2	-
CO4	3	3	2	2	2	1	1	1	3	2	2	-
CO5	3	2	2	2	2	-	1	3	2	2	3	-

CO6	2	2	3	2	3	2	1	2	1	1	3	-

Module No	Content of Module	Hrs	COs
1	**INTRODUCTION** Definition of Surveying, Classification of Surveys, Uses of Surveying modes of Measurements, Map & Classification, Survey of India topographical Maps and their numbering., Basic principles of surveying, Chain and types, Tape and types, EDM devices, Ranging of lines Direct and Indirect, Measurement of distances over sloping grounds, Chain and Tape corrections - Numerical problems, precision and accuracy.	09	CO1
	LIST OF EXPERIMENTS 1. Set out perpendiculars at various points on given line using cross staff, optical square and tape.	04	
2	**CHAIN SURVEYING** Working principle and use of optical square, prism square, cross staff. Obstacles in chain survey, Numerical problems, **AREAS AND VOLUMES** Calculation of area from cross staff surveying, Calculation of area of a closed traverse by coordinates method. Planimeter – principle of working and use of planimeter to measure areas, digital planimter, Computations of areas and volumes by trapezoidal and prismoidal rule, Capacity contours	09	CO1,CO2
	LIST OF EXPERIMENTS Setting out of rectangle, hexagon using tape/chain and other accessories.	08	
3	**COMPASS SURVEYING** Meridians and bearings, Principle working and use of – Prismatic compass, Surveyor's compass, Magnetic bearing, true bearings, WCB and Reduced bearing. Dip and Declination Traverse - closed and open traverse, Computation of bearings of legs of closed traverse given the bearing of one of the legs, Computation of included angles given the	09	CO1, CO2, CO3

	bearings of legs of a closed traverse. Local attraction, determination and corrections, Dependent and independent co-ordinates, Omitted measurements (Only Length and corresponding bearing of one line).		
	LIST OF EXPERIMENTS 1. To set out rectangles, pentagon, 2. To set out hexagon, using tape /chain and compass.	08	
4	**INTRODUCTION TO LEVELLING** Principles and basic definitions, Fundamental axes and part of a dumpy level, Types of adjustments and objectives, Temporary adjustments of a dumpy level, Curvature and refraction correction, Type of leveling, Simple leveling, Reciprocal leveling, Profile leveling, Cross sectioning, Fly leveling, Booking of levels Rise and fall method and Height of instrument method comparison Arithmetic checks Fly back leveling., Errors and precautions.	09	CO1,CO5
	LIST OF EXPERIMENTS 1. To determine difference in elevation between two points using fly leveling technique & to conduct fly back leveling. Booking of levels using both HI and Rise & Fall methods. 2. To determine difference in elevation between two points using reciprocal leveling and to determine the collimation error. 3. To conduct profile leveling for water supply /sewage line and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level	08	
5	**CONTOURING & PLANE TABLE SURVEYING** Contours and their characteristics, Methods of contouring, direct and indirect methods, Interpolation techniques, Uses of contours Numerical problems on determining indivisibility, Grade contours and uses. Plane table and accessories, Advantages and limitations of plane table survey, Orientation and methods of orientation, Methods of plotting – Radiation, Intersection, Traversing, Resection method, Two point and three point problems, Solution to two point problem by graphical	09	CO1,CO6

	method, Solution to three point problem Bessel's graphical method, Errors in plane table survey.		
	LIST OF EXPERIMENTS 4. To determine the distance between two inaccessible points using chain/tape & compass. 5. To locate points using radiation and intersection method of plane tabling. 1. To solve 3-point problem in plane tabling using Bessel's graphical solution.	12	

TEXT BOOKS:

1. '**Surveying'** Vol 1 - B.C. Punmia , Er. Ashok Kr. Jain, Dr.Arun Kumar Jain, Laxmi Publications, New Delhi.Edition: 16th (2016), ISBN: 8170088836.
2. **'Surveying'** Volume 1 **-** S. K. Duggal, Tata McGraw-Hill Education India,4th Edition, ISBN:9781259028991.
3. **'Plane Surveying'** A. M. Chandra – New age international (P) Ltd,3rd Edition (Reprint 2015), ISBN 978-81-224-3880-2

REFERENCE BOOKS:

1. **Fundamentals of Surveying -** Milton O. Schimidt – Wong, Thomson Learning.
2. **Fundamentals of Surveying -** S.K. Roy – Prentice Hall of India, 2nd Edition, ISBN 978-81-203-4198**.**
3. **Surveying**, Arther Bannister et al., Pearson Education, India, 7th Edition (2006), ISBN 9788131700662

CIE- Continuous Internal Evaluation (Theory- 50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	30	10	10
Remember	5	-	5
Understand	10	5	-
Apply	15	5	5

Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-

CIE- Continuous Internal Evaluation (Practical 25 Marks)

Bloom's Category	Practical's
Marks (out of 25)	25
Remember	5
Understand	5
Apply	15
Analyze	-
Evaluate	-
Create	-

SEE: Semester End Examination (Theory-50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	10
Apply	25
Analyze	5
Evaluate	-
Create	-

SEE: Semester End Examination (Practical -25 Marks)

Bloom's Category	**Test**
Remember	5
Understand	5
Apply	15
Analyze	-
Evaluate	-
Create	-

MECHANICS OF FLUIDS

Course Code : 16CIV36 **Credits : 5**

L: P: T: S : 3:2:0:0 **CIE Marks : 50+25**

Exam Hours : 03+03 **SEE Marks : 50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the properties of fluids and fluid statics
CO2	Solve kinematic problems such as finding particle paths and stream lines
CO3	Use important concepts of continuity equation, Bernoulli's equation and apply the same to problems
CO4	Analyze laminar and turbulent flows
CO5	Have an understanding of the basic concepts of fluid measurement and dimensional analysis
CO6	Have an understanding of dynamics of fluid and losses in pipe line

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**POI0**	**POII**	**PO12**
CO1	2	1	1	-	1	1	1	1	-	-	3	1
CO2	3	2	2	2	2	1	1	1	-	-	2	-
CO3	3	3	3	2	2	1	1	1	2	1	3	-
CO4	3	2	2	1	2	1	1	1	1	-	3	-

CO5	3	2	3	2	2	1	1	1	1	1	3	-
CO6	3	3	2	2	1	2	1	1	1	1	3	-

Module No	Content of Module	Hrs	COs
1	**Introduction:** Definition of fluid, , Fluid Properties: mass density, Specific Volume, Specific Weight, Specific Gravity- Definitions, Units and Dimensions, Viscosity, Newton's Law of Viscosity, compressibility and bulk modulus, Newtonian & Non-Newtonian Fluids, Ideal & Real Fluids, Surface Tension, Capillarity rise in a vertical tube and between two plane surface, Problems on Fluid Properties. **Hydrostatics :** Definition of Total Pressure, centre of pressure, Total pressure &centre of pressure on Vertical and Inclined plane surfaces, Buoyancy and flotation, stability of floating and submerged bodies, Meta centric height and its determination.	09	C01
	List of Experiments 1. To determine the coefficient of discharge of collecting tank. 2. To determine the coefficients of orifices	08	
2	**Kinematics of Fluid Flow:** Description of Fluid Flow, Classification of fluid flow, Stream line, Streak Line, Path Line, Stream tube, Acceleration of Flow in one dimensional flow, types of accelerations, Continuity Equation in differential form, definition of velocity potential, stream potential, equipotential line, Line of constant stream line, Problems. **Dynamics of Fluid Flow:** Concept of Inertia force and other forces causing Motion, Derivation of Euler's & Bernoulli's Equation (Both for Ideal Fluids).	09	C02, C03, C06

	List of Experiments 1. Verification of Bernoulli's theorem 2. Lab Experiment assignment I	08	
3	**Measurement of depth**- Point and hook gauge, Staff gauge, weight gauge, floating gauge. Flow Measurement:- Measurement of velocity-Pitot tubes, current meter. **Fluid Pressure & Its Measurement:** Definition of Pressure, Units & Dimensions, Pressure at a point in a static fluid, Hydrostatic pressure law, Absolute, Gauge & Vacuum Pressure, Measurement of Pressure- Simple & Differential Manometers- Theory & Problems.	09	C01, C05
	List of Experiments 1. To find the coefficient of discharge over rectangular and trapezoidal notch 2. To find the coefficient of discharge in venture flume 3. To find the coefficient of discharge over broad crested and ogee weir	08	
4	**Laminar and turbulent flow** - Reynold's number - shear stress and pressure gradient - Laminar flow between parallel plates - Couette flow - Hagen Poiseuille equation for flow through circular pipes. Turbulence - semi empirical theories –Major losses - Darcy-Weisbach equation for flow through circular pipe - Friction factor - Smooth and rough pipes Minor losses - pipes in series and parallel - Equivalent length - Introduction to water hammer phenomena.	09	C04, C06
	List of Experiments 1. To determine the coefficient of friction of pipes of different diameters. 2. To determine the coefficient of discharge of venturimeter	08	
5	**Dimensional Analysis:** Introduction, Dimension, Dimensional Homogeneity, Methods- Rayleigh & Buckingham Pi Method, Dimensionless numbers-Reynold's number, Froude number, Euler	09	C05

	number, Weber number, mach number, Problems. **Measurement of discharge**-venturimeter and orifice meters, venturiflume, orifices, notches (Rectangular and V-notches) and weirs (Sharp crested Weirs)		
	List of Experiments 1. To study the flow over V notch and to find the coefficient of discharge. 2. To determine the coefficients of mouth piece 3. Lab Experiment assignment II	08	

Text Books

1. P.N.Modi & S.M.Seth , "Hydraulics & Fluid Mechanics", Standard Book House, New Delhi,(ISBN: 8190089374),15th edition.
2. R.K.Bansal, "A text book of Fluid Mechanics", Laxmi Publications, New Delhi, (ISBN-13: 978-8131808153), 9th edition.
3. K.L.Kumar, S, "Fluid Mechanics". Chand & Company Ltd, New Delhi, (ISBN: 8121901006, 9788121901000),8th edition.

Reference Books

1. Fluid Mechanics- Victor L Streeter & E. Benjamin Wylie, Mc-Graw Hill publications.
2. Fluid Mechanics- Frank M White, Sixth Edition, the Mc-Graw Hill Companies.
3. Fundamentals of Fluid Mechanics- Bruce R Munson & Donald F Young, John Wiley & Sons, Inc.

CIE- Continuous Internal Evaluation (Theory-50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks	30	10	10
Remember	10	2	2
Understand	10	2	3
Apply	10	6	5
Analyze	-	-	-
Evaluate	-	-	-

CIE- Continuous Internal Evaluation (Practical- 25 Marks)

Bloom's Category	Practical
Remember	5
Understand	10
Apply	10
Analyze	-
Evaluate	-

SEE: Semester End Examination (Theory-50 Marks)

Bloom's Category	**Tests**
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

SEE: Semester End Examination (Practical 25 Marks)

Bloom's Category	**Marks**
Remember	5
Understand	10
Apply	10
Analyze	-
Evaluate	-

FOURTH SEMESTER

(SYLLABUS)

ENGINEERING MATHEMATICS – IV

Course Code : 16MAT41 **Credits : 05**
L:P:T:S : 4:0:1:0 **CIE Marks : 50**
Exam Hours : 03 **SEE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to do the following**:**

CO1	Solve initial value problems using appropriate numerical methods
CO2	Understand the concepts of Complex variables and transformation for solving Engineering Problems
CO3	Understand the concepts of complex integration, Poles and Residuals in the stability analysis of engineering problems
CO4	Gain ability to use probability distributions to analyze and solve real time problems
CO5	Apply the stochastic process and Markov Chain in prediction of future events
CO6	Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous probability and statistical methods

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2	2	-	-	-	2	1	-	2
CO2	3	3	3	2	2	-	-	-	1	1	-	1
CO3	3	3	2	3	2	-	-	-	2	1	-	2
CO4	3	2	2	2	3	-	-	-	1	3	-	1
CO5	2	2	3	3	2	-	-	-	1	3	-	1
CO6	3	3	3	2	3	-	-	-	2	2	-	1

Syllabus			
Module	**Contents of the Module**	**Hours**	**COs**
1	Numerical Methods: Numerical solution of ordinary differential equations of first order and of first degree: single step methods- Picard's Method, Taylor's series method, modified Euler's method and Runge-Kutta method of fourth-order. Multi step methods- Milne's and Adams- Bashforth predictor and corrector methods. Numerical solution of simultaneous first order differential equations ; Picard's Method and Runge-Kutta Method of fourth-order(no derivation of formulae)	9	CO1
2	Complex Variables: Functions of a complex Variables, Analytical functions, Cauchy's Riemann Equations in Cartesian and Polar forms, Harmonic functions and Construction of analytic functions. Discussion of Transformations: $w = z^2$, $w = e^Z$ and $w = z + (1 / z)$ and Bilinear Transformations.	9	CO2
3	Complex Integrations: Complex line integrals – Cauchy's theorem and Cauchy's Integral formula. Power Series, Laurent's series. Singularities, Poles and Residuals, Residual Theorem-problems (without proof).	9	CO3
4	Probability distributions: Random variables (discrete and continuous), probability density function, cumulative density function. Discrete Probability distributions: Binomial and Poisson distributions. Continuous Probability distributions; Exponential and normal distributions. Joint Probability distributions:, Mathematical expectation, correlation, covariance (discrete random variables only).	9	CO4
5	Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution for test of goodness of fit.	9	CO5, CO6

	Stochastic Processes: Stochastic processes, Probability Vectors, Stochastic matrix, Regular stochastic matrix, Markov chains, Higher transition probabilities, Stationary distribution of regular Markov chains and absorbing states		

Text Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition,2014, Wiley-India publishers.

2 . Higher Engineering Mathematics, B.S.Grewal, 43nd edition, 2014, Khanna Publishers .

Reference Books:

1. Advanced Modern Engineering Mathematics, Glyn James, 4th edition, 2015, Pearson Education.
2. Advanced Engineering Mathematics, Dennis G. Zill, Michael R. Cullen, 4th edition, 2015, Jones
and Barlett Publishers Inc.
3.Engineering Mathematics, B. V. Ramana, 4th edition, 2005, Tata McGraw Hill Publications.
4. Engineering Mathematics, Anthony Craft, 4th edition, 2013, Pearson Education.

Assessment Pattern

1. CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (30 Marks)	Assignments (10 Marks)	Quizzes (10 Marks)
Remember	10	3	5
Understand	5	5	5
Apply	5	2	
Analyze	5		
Evaluate	5		
Create			

2. SEE- Semester End Examination (50 Marks)

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	

EARTH SCIENCE ENGINEERING

Course Code : 16CIV43 **Credits : 03**

L: P: T: S : 3: 0: 0: 0 **CIE Marks : 50**

Exam Hours : 03 **SEE Marks: 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Know and understand about the geological process, different types of landforms, weathering of rocks, soil formation, internal structure of earth, branches of geology and the applications of geology in the field of Civil Engineering.
CO2	Know and understand about physical properties of minerals, three fold classification of rocks and description of some important minerals and rock specimens and their engineering uses.
CO3	Know and understand about the concept of continental drift, plate tectonics; causes, affects and remedial measures to control adverse effects of geological hazards like earthquake, landslide and tsunami.
CO4	Know and understand about physic-mechanical properties of rocks, geological structures, their causes & effects on Civil Engineering projects.
CO5	Gain basic knowledge about ground water and geological investigations required for Civil Engineering projects like bridge, tunnel, reservoirs, dams etc.
CO6	Know and understand about the basic principles of remote sensing, GIS, GPS and their applications in the field of Civil Engineering.

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	-	-	2	-	1	1	-	-	2	2	-
CO2	2	2	-	-	-	1	1	-	-	2	2	-
CO3	2	2	-	2	2	2	2	-	-	3	2	-
CO4	3	2	2	2	2	3	3	1	1	2	2	-
CO5	2	2	2	2	2	3	3	1	1	2	2	-
CO6	2	2	3	2	3	2	2	-	-	2	3	2

Module No	Module Contents	Hrs	COs
1	**Introduction**: Earth, its position in Solar System and other basic information (mass, shape, size, density, etc.), earths internal structure and its composition. Geology, branches of Geology and importance of geology in the field of Civil Engineering (few case studies of failure of some Civil Engineering constructions due to geological draw backs). **Geomorphology and Stratigraphy:** Geological agents, Epigene and Hypogene geological agents, Weathering of rocks, types of weathering, Formation of soil and its classification, Soil profile, Soil erosion and its conservation, Geological action of rivers with different drainage patterns; Geological action of wind. Introduction to geological time scale and stratigraphy, Laws of stratigraphy.	09	CO1
2	**Mineralogy:** Definition of Mineral, classification of minerals (rock forming and ore forming), Physical properties of Minerals. Description of the following minerals with engineering uses; Quartz and its varieties: Rock crystal, Rose quartz, Milky quartz, Amethyst, Agate, Flint, Chert, Jasper, Blood Stone and Opal; Feldspar group: Orthoclase, Microcline and Plagioclase; Mica group: Muscovite and Biotite; Carbonate group: Calcite, Magnesite and Dolomite; Clay mineral group: Kaolin; Sulphate group: Gypsum; Other silicate minerals: Olivine, Garnet, Talc and Asbestos. Ore minerals: Magnetite, Hematite, Limonite, Pyrite, Chalcopyrite, Pyrolusite, Psilomalane, Chromite, Galena, Bauxite. **Petrology**: Definition of rock and its threefold classification. Igneous rocks: Origin, classification (chemical and textural) and forms of igneous rocks; description and engineering uses of Granite, Gabbro, Dunite; Pegmatite, Dolerite; Basalt and Pumice. Sedimentary rocks: Origin, classification, primary structures of sedimentary rocks; description and engineering uses of Sandstones, Conglomerate, Shale, Limestones and Laterite. Metamorphic rocks: Agents and types of metamorphism, description and	09	CO2

	engineering uses of Gneiss, Quartzite, Marble, Slate and Schists.		
3	**Geodynamics**: Elementary idea about continental drift, Plate Tectonics, neotectonics and sea floor spreading; Earthquakes - Classification, causes, effects and remedial measures to control adverse of effects of earthquakes, locating epic centre, seismic waves, seismographs, seismograms, accelograms, seismic zones of India, seismic resisting structures; tsunamis; Landslides: causes, effects and remedial measures. **Structural geology**: Out crop, bedding plane, vertical thickness and true thickness (including Problems), Dip and strike (including surface and sub-surface method problems), Clinometer-compass; Terminologies, causes and Classification of Fold, Fault and Joints their identification in the field & their effects on Civil Engineering structures.	09	CO3 and CO4
4	**Geological investigations:** Study of toposheets and geological maps, Geological considerations in the Civil Engineering projects like dams, reservoirs, tunnels, roads and bridges. Dams and reservoirs: Preliminary and detailed geological investigations for a dam site, important international and Indian examples of failures of dams and their causes, factors affecting the seepage and leakage of the reservoirs and the remedial measures, silting of reservoirs. Tunnel, roads and bridges: Purposes of tunneling and geological problems connected with tunneling, geological considerations in road alignment, roads in complicated regions, problems after road construction, geology of bridge sites. **Hydrogeology**: Hydrological cycle; vertical distribution of ground water in the earth crust; Water bearing properties of geological formation: Porosity, Permeability, Specific yield and Specific retention, aquifers, aquicludes, aquifuges and aquitards. Aquifers and their types; Geological, hydrological and geophysical (mainly electrical resistivity method) investigations for ground water exploration; artificial recharge of groundwater and rain water harvesting.	09	CO4 and CO5

5	**Remote sensing and Geographical Information System**: Introduction to remote sensing, Spectral signature, Atmospheric windows. Remote sensing platforms and sensors. Aerial photographs and satellite Imageries. Application of remote sensing in the field of Civil Engineering. Concept of Geographical information system (GIS), its components and applications in the field of Civil Engineering. Concept of Global Positioning System (GPS) and its applications **Rock Mechanics:** Definition, importance and status of rock mechanics in Civil Engineering, Rock mass Classification Systems: Q-system, RMR, Modified RMR and their applications. Rock Quality Determination (RQD), Physico-Mechanical Properties of Rocks: Specific gravity, hardness, porosity, moisture content, permeability, thermal conductivity, compressive, tensile and shear strengths.	09	CO4 and CO6

Text Books:

1. Text of Engineering and General Geology by Parbin Singh, Published by S. K. Kataria and Sons, New Delhi., 8th Edition: 2008. Reprint-2015. ISBN 978-93-5014-267-7

2. Engineering Geology for Civil Engineering by D. Venkata Reddy, Vikas Publishing House Pvt Ltd, Published 2014. ISBN 9788125919032.

3. Text book of Geology by P.K. Mukerjee, World Press Pvt. Ltd. Kolkatta., Published 2015. ISBN 978-81-8756-754-7.

Reference Books:

1. Remote sensing and GIS by M. Anji Reddy, *B. S. Publications,* Hyderabad*.,* Published 2012. ISBN 978-93-8107-597-5.

2. Ground water geology by Todd D.K. John Wiley and Sons, New York. 2nd Edition: 2010. ISBN 978-81-265-0836-5.

3. Introduction to Rock Mechanics by Goodman, Wiley International (1989). ISBN 9780471812005), 6th Edition, 2015.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Self Study
Marks (out of 50)	30	10	10
Remember	10	-	5
Understand	10	5	-
Apply	5	-	5
Analyze	5	5	-
Evaluate	-	-	-
Create	-	-	-

SEE – Semester End Examination (50 Marks)

Bloom's Category	**Tests (Theory)**
Remember	15
Understand	15
Apply	10
Analyze	10
Evaluate	-
Create	-

ANALYSIS OF DETERMINATE STRUCTURES

Course Code : 16CIV44 **Credits : 3**

L: P: T: S : 3:0:0:0 **CIE Marks : 50**

Exam Hours : 03 **SEE Marks : 50**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Distinguish between stable and unstable and statically determinate and indeterminate structures.

CO2	Apply principles of statics to determine reactions & internal forces in statically determinate structures
CO3	Calculate deflection of beams and trusses using energy concepts
CO4	Calculate the deflections of beams and trusses under different loading conditions.
CO5	Calculate the internal forces and resultant stresses in cable and arch type structures.
CO6	Understand the concept of influence lines and construct influence line diagram for determinate beams.

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**POI0**	**POII**	**PO12**
CO1	3	3	2	2	2	-	-	-	-	2	3	-	3
CO2	3	3	2	2	2	-	-	-	-	2	3	-	3
CO3	3	2	1	1	1	1	-	-	-	2	3	-	3
CO4	2	3	2	1	2	1	-	-	1	2	3	-	2
CO5	3	3	2	2	1	1	-	-	-	2	3	-	3
CO6	3	3	2	2	1	-	-	-	-	2	3	-	3

Module No	**Content of Module**	**Hrs**	**COs**

1	**INTRODUCTION TO STRUCTURAL SYSTEMS: Classification of structures,** Forms of structures, Conditions of equilibrium, Degree of freedom, Linear and Non linear structures, one, two, three dimensional structural systems, Determinate and indeterminate structures [Static and Kinematics]**.** Types of trusses, Assumptions in analysis-Analysis of determinate trusses by method of joints and method of sections.	07	CO1, CO3
2	**DEFLECTION BY ENERGY CONCEPT AND THEOREMS** Strain energy and complimentary strain energy, Strain energy due to axial load, bending moment and shear force, Theorem of minimum potential energy, principle of virtual work, Deflection of determinate beams and trusses using total strain energy, Castigliano's theorems and their applications in the analysis of beams, bent frames and trusses. Application of Unit load methods to beams and trusses.	11	CO2, CO3
3	**DEFLECTION OF BEAMS** Introduction – Definitions of slope, deflection, Elastic curve derivation of differential equation of flexure, Sign convention Slope and deflection for standard loading classes using Macaulay's method for prismatic beams and overhanging beams subjected to point loads, UDL and Couple. Deflection of determinate beams by Moment area method and Conjugate beam method.	09	CO2, CO4
4	**ARCHES AND CABLES STRUCTURES** Three hinged circular and parabolic arches with supports at same levels and different levels, Determination of thrust, shear and bending moment. Analysis of cables under point loads and UDL, length of cables. (Supports at same levels and at different levels).	09	CO5

5	**ROLLING LOAD AND INFLUENCE LINES:** Concept of influence lines- ILD for reactions, SF and BM for determinate beams- ILD for axial forces in determinate trusses- BM, SF and axial forces in determinate systems using ILD- Maximum BM and SF in determinate beams using rolling loads concepts.	09	CO6

TEXT BOOKS:

1. "Theory of Structures" S.Ramamurtham,Dhanpath Rai Publications, Edition 2014,ISBN-9789384378103
2. "Structural Analysis" Vaidyanathan.R & Perumal. P, Vol. I & II", Laxmi Publications, (ISBN: 978-81-318-0781-1), 3rd Edition, 2007.
3. "Structural Analysis" Bhavikatti, S S Vol. I & II, Vikas Publishing House Pvt.(ISBN: 9788125942696), 4th Edition, 2010.

REFERENCE BOOKS:

1. "Structural Analysis", Thandavamoorthy, Oxford University Press Higher Education,(ISBN: 9780198069188), 3rd Edition, 2012.
2. "Theory of Structures", Pandit G. S, and Guta S.P., Vol. – I, Tata McGraw Hill, New Delhi,(ISBN: 9780074634936) , 10th Edition, 2014
3. "Structural Analysis", Devdas Menon, Narosa Publishing House, (ISBN: 978-81-7319-750-5), 2014
4. "Basic Structural Analysis", Reddy C. S., Tata McGraw Hill, New Delhi, (ISBN: 9780070702769), 4th Edition ,2011.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	**30**	**10**	**10**
Remember	2	1	2
Understand	8	2	3
Apply	10	5	2
Analyze	10	2	3
Evaluate	-	-	-
Create	-	-	-

SEE: Semester End Examination (50 Marks)

Bloom's Category	Tests
Remember	5
Understand	15
Apply	15
Analyze	15
Evaluate	-
Create	-

HIGHER SURVEYING

Course Code : 16CIV45 **Credits : 05**

L:P:T:S : 3:2:0:0 **CIE Marks : 50**

Exam Hours. : 03 **SEE Marks : 50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the principles and working of basic instruments like Theodolite, Total station.
CO2	Acquire the concepts of setting out the curves by linear and angular methods.
CO3	Undertake the Surveying work of mega projects requiring instruments with highest degree of accuracy.
CO4	Familiarize with the advanced methodologies involving chainless survey using trigonometrical surveying and total station.
CO5	Impart theoretical and practical knowledge in calculation of earthworks, designing, construction of highways and railways requiring horizontal and vertical curves to be designed for specific speeds.
CO6	Understand the application of GPS and GIS

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	2	2	2	3	-
CO2	3	3	1	-	-	2	-	2	2	2	2	-
CO3	2	1	-	-	2	2	-	2	2	2	2	-
CO4	3	3	2	2	2	1	1	1	3	2	2	-
CO5	3	2	2	2	2	-	1	3	2	2	3	-
CO6	2	2	3	2	3	2	1	2	1	1	3	-

Module No	Content of Module	Hrs	COs
1	**THEODOLITE SURVEY** Theodolite and types, Fundamental axes, Interrelationship between fundamental axes, parts of a transit theodolite, Uses of theodolite, Temporary adjustments of a transit theodolite, Measurement of horizontal angles – Method of repetitions and reiterations, Measurements of vertical angles, Prolonging a straight line by a theodolite in adjustment and theodolite not in adjustment	09	CO1
	List of Experiments 1. Measurement of horizontal angles with method of repetition and reiteration using theodolite, Measurement of vertical angles using theodolite. 2. To determine the elevation of an object using single plane method when base is accessible and inaccessible.		
2	**TRIGONOMETRICALLY LEVELLING** Determination of elevation of objects when the base is	09	CO1,CO2,CO4

	accessible and inaccessible by single plane and double plane method, Distance and difference in elevation between two inaccessible objects by double plane method. Salient features of Total Station, Advantages of Total Station over conventional instruments, Application of Total Station		
	List of Experiments 1. To determine the distance and difference in elevation between two inaccessible points using double plane method. 2. To determine the tachemetric constants using horizontal and inclined line of sight.		
3	**CURVE SETTING (Simple Curve and Compound Curve)** Curves – Necessity – Types, Simple curves, Elements, Designation of curves, Setting out simple curves by linear methods, Setting out curves by Rankines deflection angle method.	09	CO1,CO3,CO5
	List of Experiments 1. To set out simple curves using linear methods – perpendicular offsets from long chord and offsets from chords produced. 2. To set out simple curves using Rankine's deflection angles method.		
4	**CURVE SETTING (Compound Curve and Reverse curves, curves)** Compound curves Elements Design of compound curves Setting out of compound curves,Reverse curve between two parallel straights (Equal radius and unequal radius).	09	CO1,CO3,CO5
	1. To set out compound curve with angular methods with using theodolite only.		
5	(**Transition and Vertical Curves)** Transition curves Characteristics Length of Transition curve Setting out cubic Parabola and Bernoulli's Lemniscates, Vertical curves –	09	CO1

	Types – Simple numerical problems. Introduction to Photogrammetric, GIS and GPS, and its application.		
	List of Experiments 1. To set out the center line of a simple rectangular room suing offset from base line 2. To set out center lines of columns of a building using two base lines at right angles 3. Demonstration Exposure to use of Total Station. Traversing, Longitudinal sections, Block levelling, Usage of relevant softwares for preparation of the contour drawings.		

TEXT BOOKS:

1. '**Surveying'** Vol 2 and Vol 3 - B.C. Punmia , Er. Ashok Kr. Jain, Dr.Arun Kumar Jain, Laxmi Publications, New Delhi.Edition: 16th (2016), ISBN: 8170088836.
2. **'Plane Surveying'** A. M. Chandra – New age international (P) Ltd,3rd Edition (Reprint 2015), ISBN 978-81-224-3880-2
3. **'Higher Surveying'** A.M. Chandra New age international (P) Ltd, 3rd Edition (2015),

REFERENCE BOOKS:

1. **Fundamentals of Surveying -** Milton O. Schimidt – Wong, Thomson Learning.
2. **Fundamentals of Surveying -** S.K. Roy – Prentice Hall of India, 2nd Edition, ISBN 978-81-203-4198**.**
3. **Surveying**, Arther Bannister et al., Pearson Education, India, 7th Edition (2006), ISBN 9788131700662

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	30	10	10

Remember	5	-	5
Understand	10	-	5
Apply	10	10	-
Analyze	5	-	-
Evaluate	-	-	-
Create	-	-	-

SEE: Semester End Examination (50 Marks)

Bloom's Category	**Tests (Theory)**	**Test (Practical)**
Remember	10	5
Understand	15	10
Apply	20	10
Analyze	5	-
Evaluate	-	-
Create	-	-

APPLIED HYDRAULICS AND MACHINERY

Course Code : 16CIV46 **Credits : 5**

L: P: T: S : 3:2:0:0 **CIE Marks : 50+25**

Exam Hours : 03+03 **SEE Marks : 50+25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Visualize fluid flow phenomena observed in open channel flow.
CO2	Design open channels for most economical sections like rectangular, trapezoidal and circular sections
CO3	Understand the basics of impulse momentum
CO4	Understand the working of basic hydraulic machines and Design of turbines

CO5	Understand the basics of pumps
CO6	Working of fluid systems

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
CO1	2	2	1	3	1	2	2	1	1	1	3	-
CO2	3	3	3	2	2	2	1	1	1	1	3	-
CO3	2	2	2	3	1	1	1	1	1	1	3	-
CO4	3	3	3	2	1	3	2	1	1	1	3	-
CO5	3	3	3	2	1	3	2	1	1	1	3	-
CO6	3	3	2	2	1	3	1	1	1	1	3	-

Module No	Content of Module	Hrs	COs
1	**FLOW IN OPEN CHANNELS:** Definition of channel, difference between pipe and open channel flow, classification, types of flows, geometric properties of open channels, Uniform flow in open channels, Chezy's& Manning's formula, Most economical open sections- rectangular, trapezoidal, circular sections- derivations & problems. Specific Energy, definitions, Specific Energy curve, condition for Maximum discharge & Minimum specific energy, critical flow in rectangular sections, problems	09	C01, C02
	List of Experiments 1. To study of hydraulic jump. 2. To determine the metacentric height of a ship model.	08	
2	**FLOW IN OPEN CHANNELS (NON-UNIFORM FLOW):** Definition, Types of Non- Uniform flows, Gradually Varied flow- derivation & Problems, Classification of channel bottom slopes, hydraulic jump, and hydraulic jump in a rectangular channel, types & applications.	09	C01, C02
	List of Experiments	08	

	1. To find the coefficients of vertical orifice 2. Calibration of Dead weight pressure gauge 3. Lab Experiment assignment I		
3	**IMPACT OF JET ON FLAT VANES:** Introduction to Impulse – momentum equation and its applications, Force exerted by a jet on a fixed target, Derivations, Force exerted by a Jet on a moving target, Derivations. **IMPACT OF JET ON CURVED VANES:** Force exerted by a jet on a series of curved vanes, Concept of velocity triangles, Equation for work done & efficiency, Problems o force exerted by a Jet on a series of curved vanes.	09	C03
	List of Experiments 1. To determine the coefficient of impact of jet on flat vanes 2. To determine the coefficient of impact of jet on inclined and curved vanes	08	
4	**TURBINES:** Definition, classification, Pelton turbine, theory, equation for work done & efficiency, problems, Kaplan turbine, Introduction, Components, Working and Velocity triangles, Properties of the Turbine, Discharge of the Turbines, Number of Blades-Problems. Draft Tube: Types, efficiency of a Draft tube. Introduction to Cavitation in Turbines	09	C04
	List of Experiments 1. To study the efficiency of Pelton turbine 2. To study the efficiency of Kaplan turbine.	08	
5	**PUMPS:** Definition,classification general principle, Centrifugal pumps- priming, work done minimum starting speed, problem **FLUID SYSTEM**: Working of Hydraulic press, Hydraulic ram, Hydraulic lift, Hydraulic crane.	09	C05, C06
	List of Experiments 1. To study the efficiency of Centrifugal pumps. 2. To determine the minor losses in a pipe line. 3. Lab Experiment assignment II	08	

Text Books

1. “Hydraulics & Fluid Mechanics”, P.N.Modi & S.M.Seth , Standard Book House, New Delhi, (ISBN: 8190089374),15th edition.

2. “A text book of Fluid Mechanics”, R.K.Bansal, Laxmi Publications, New Delhi,(ISBN-13: 978-8131808153), 9 th edition.

3. “Fluid Mechanics”. K.L.Kumar, S, Chand & Company Ltd, New Delhi,(ISBN: 8121901006, 9788121901000).8th edition.

Reference Books

1. Fluid Mechanics- Victor L Streeter & E. Benjamin Wylie, Mc-Graw Hill Publications.
2. Fluid Mechanics- Frank M White, Sixth Edition, the Mc-Graw Hill Companies.
3. Fundamentals of Fluid Mechanics- Bruce R Munson & Donald F Young, John Wiley & Sons, Inc.

Assessment method:

Bloom’s Category	Tests	Assignments	Quizzes	Practical
Marks (50+25)	30	10	10	25
Remember	10	5	4	5
Understand	5	-	2	5
Apply	10	2	2	10
Analyze	5	3	2	5
Evaluate	-	-	-	-
Create	-	-	-	-

SEE: Semester End Examination (50 Marks)

Bloom’s Category	**Tests (Theory)**	**Test (Practical)**
Remember	19	5
Understand	7	10
Apply	9	10
Analyze	15	-
Evaluate	-	-
Create	-	-

BULDING PLANNING AND DRAWING

Course Code : 16CIV47 **Credits : 02**

L:P:T:S : 0:2:0:0 **CIE Marks : 25**

Exam Hours. : 03 **SEE Marks : 25**

CO1	Learning of Auto Cad software
CO2	Learn the layer concepts along with the other commands
CO3	Imparts the knowledge of preparing working drawings for individual components of building like foundations, doors and windows etc
CO4	Designing of building right from the conception to the evolution of preparing bubble diagrams, line diagram, plan, elevation and sections.
CO5	working drawings for preparing water supply, sanitary and electrical layout
CO6	Learning of visualization of drawings & to read the working drawings

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
CO1	3	2	3	2	1	1	1	1	1	1	3	1
CO2	3	3	3	3	1	1	1	1	2	1	3	1
CO3	3	3	3	3	1	1	1	1	1	1	3	1
CO4	3	3	3	3	2	1	2	1	1	2	3	1
CO5	3	3	3	3	2	1	2	1	1	2	3	1
CO6	3	1	2	2	1	1	1	1	1	1	3	1

Exercise No	Content of Exercise	Hrs	COs
1	**BASICS OF AUTOCAD:** DRAWING TOOLS: Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy,	08	C01, C02

	Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings		
2	1. To prepare geometrical drawing of i) Stepped wall & RCC Isolated footing 2. To prepare geometrical drawing of Fully paneled and flush doors, 3. To prepare geometrical drawing of half paneled and half-glazed window. 4. To prepare geometrical drawings of Doglegged and Open well stairs (Manual and CAD)	08	C03, CO4,
3	1. To prepare geometrical drawing of Steel truss. 2. Functional design of building (Residential, Public and Industrial), positioning of various components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio. 3. Functional design of building using inter connectivity diagrams (bubble diagram), development of line diagram only for Primary health centre & Primary school building.	08	C03, CO4,
4	1. Functional design of building using inter connectivity diagrams (bubble diagram), development of line diagram only for College canteen 2. Functional design of building using inter connectivity diagrams (bubble diagram), development of line diagram only for Office building 3. Development of plan, elevation, section and schedule of openings from the given line diagram of two bed room, single storeyed residential buildings (Manual and CAD)	08	C04, CO6,
5	1. Development of plan, elevation, section and schedule of	08	CO5 ,

	openings from the given line diagram of two storeyed residential building. 2. For a given single line diagram, preparation of water supply, sanitary and electrical layouts		CO6

REFERENCE BOOKS :

1. **"Building Drawing"**, Shah M.H and Kale C.M, Tata Mc Graw Hill Publishing co. Ltd., New Delhi, , 4th edition, 2007 ISBN: 0074638769
2. **"Building Planning, Designing and Scheduling",** Gurucharan Singh, Standard Publishers & distributors, New Delhi, 2006, ISBN: 9788180140051
3. **National Building Code,** BIS, New Delhi.
4. "**Introduction to AutoCAD for Civil Engineering Applications**" Nighat Yasmin, SDC Publications, 2014, ISBN 13: 9781585038688.
5. "**AutoCad 2007 for Engineers and Designers**", Sham Tickoo, Deepak Maini, Dreamtech Press, 2006, ISBN; 9788177226935

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Tests	Assignments
Marks (out of 25)	20	05
Remember	-	-
Understand	5	-
Apply	10	-
Analyze	-	-
Evaluate	-	-
Create	5	5

SEE: Semester End Examination (25 Marks)

Bloom's Category	**Test (Practical)**
Remember	-
Understand	5
Apply	10
Analyze	-

Evaluate	-
Create	10

INTRODUCTION TO ECONOMICS

Course Code : 16HSS321/421 **Credits : 03**

L:P:T:S : 2:0:0:1 **CIEMarks : 50**

Exam Hours : 03 **SEE Marks : 50**

Course Outcomes: At the end of the Course, the student will be able:

CO1	Understand the basics of economics and different types of economics
CO2	Understand the macro – economic environment of the business and its impact on enterprise
CO3	Evaluate the national income by using various methods
CO4	Examine the money and banking system of India.
CO5	Have an in depth knowledge about budget and the economy
CO6	Analyze the balance of payment and foreign exchange markets

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Module	Module Contents	Hours	CO's
1	**Introduction :** Open, Closed and mixed economy, central problems if an economy. Organisation of economy activities, the centrally planned economy and the market economy, positive economic and normative economics. Microeconomics : Consumer behaviour rationality, revealed preferences and utility , indifference curves, utility maximization, demand functions, substitution and income effects, demand elasticity – substitutes and compliments	**5**	**CO1**
2	**Introduction to Macro economics :** Definition, Introduction to national income , circular flow of income, methods of calculating national income : Value added, expenditure and income method , macroeconomic identities goods and prices. Role of LPG and FDI in inflation.	**5**	**CO2, CO3**
3	Money and Banking role of Money, transaction motive and speculation motive, the supply of money, instruments of monetary policy and the Reserve Bank of India	**4**	**CO4**
4	Budget and the economy – Components of the government budget – the revenue account, the capital account, measures of government deficit. Fiscal policy changes in government ,expenditure, changes in taxes and debit	**4**	**CO5**
5	Open Economy macro economics – The balance of payments the foreign exchange market , determination of the exchange rate , flexible exchange rates , Fixed exchange rates and managed floating trade deficits , savings and investments	**4**	**CO6**

Textbooks

1. K.K Dewett, Modern economic theory, S Chand Publishing
2. Begg, D., S. Fischer and R. Dornbusch Economics. (McGraw Hill), 2014
3. Lipsey, R.G. and K.A. Chrystal Economics. (Oxford University Press), 2015
4. Chopra P N Principle of economics. Kalyani Publishers
5. Agrawal A N Indian Economy, Wiley Eastern Limites , New Delhi 2012

References

Introductory to Macro Economics. Text book for class 12th NCERT

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (30 Marks)	Assignments (10 Marks)	Quizzes (10 Marks)
Remember	-	-	5
Understand	-	-	-
Apply	10	-	-
Analyze	10	-	-
Evaluate	10	-	5
Create	-	10	-

SEE- Semester End Examination (50 Marks)

Bloom's Category	Questions (50 Marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	30
Create	-

Life Skills for Engineers

Course Code : 16HSS322/422 **Credits : 03**

L:P:T:S : 2:0:0:1 **CIE Marks : 50**

Exam Hours : 03 **SEE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To transform as stronger individuals to handle life challenges of professional life.
CO2	To apply the concept of Personality development & Grooming in real life.
CO3	Understand the concept of self and Creativity so that they can align with their life better.
CO4	To understand the role of motivation and leadership on behavior
CO5	To enhance holistic development of the personality and improve their employability skills.
CO6	Determine the significance of goal setting & decision making for their professional life

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	1	2	2	3
CO2	1	3	3	2	3	3	2	3	3	2	3	2
CO3	2	3	2	1	2	3	3	3	1	3	2	3
CO4	2	3	3	2	1	3	3	3	2	3	3	3
CO5	1	3	3	2	3	2	3	2	2	3	3	3
CO6	2	2	3	1	2	2	3	2	2	3	3	3

Module

Sl No	Contents of Module	Hrs	CO's
1	Personality Development& Grooming : Expectations from the industry & Career Planning/Reality Check , Building personal presence , Corporate Grooming , Corporate etiqueties, developing personal work code.	**6**	**CO1**

2	Self Analysis & Creativity: SWOC analysis, Who am I attributes, Importance of Self Confidence, Self Awareness, Self Management, Social Awareness,Emotional Intelligence, out of box thinking, lateral Thinking & Johari windows	**4**	**CO2, CO3**
3	Motivation & Leadership: Basic concepts & theories, Factors, types of Motivation, Good Leadership skill, Traits of a leader & Assessment of Leadership Skill.	**4**	**CO4, CO5**
4	Interpersonal Skill: Assessing interpersonal skills situation detail of interpersonal skill, Team Working, leading a team, and Strategies for influencing people. Understanding the relationship among motivation, leadership and team work	**4**	**CO5**
5	Goal Setting and Decision Making: Identifying goals like short term, long term, lifetime goals, time management, importance of work scheduling, importance and necessity of decision making	**4**	**CO6**

Text Books: Soft Skill, 2015, Career development Centre, Green Pearl Publication.

Reference books:

1) The 7 – Habits of Highly Effective People, Stephen R Covey, Neha Publishers.
2) Convey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
3) Daniel Coleman, Emotional Intelligence, Bantam Book, 2006.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests (30 Marks)**	**Assignments (10 Marks)**	**Quizzes (10 Marks)**
Remember	-	-	-
Understand	-	-	5
Apply	5	-	5
Analyze	10	10	-
Evaluate	5	-	-
Create	5	-	-

SEE- Semester End Examination (50 Marks)

Bloom's Category	Questions (50 Marks)
Remember	5
Understand	10
Apply	15
Analyze	10
Evaluate	5
Create	5

APPENDIX A

Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

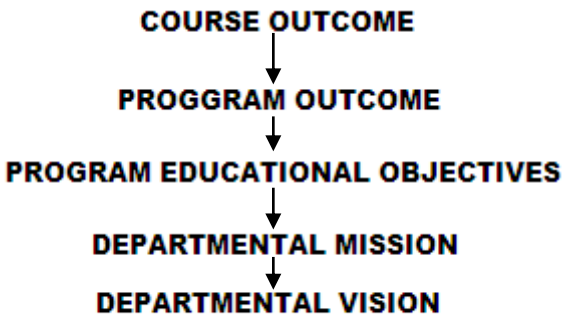
There are three educational Outcomes as defined by the National Board of Accredition:

Program Educational Objectives: The Educational objectives of an engineering degree program arethe statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes



APPENDIX B
The Graduate Attributes of NBA

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.

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

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline. * that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework. that often require use of modern computational concepts and tools.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

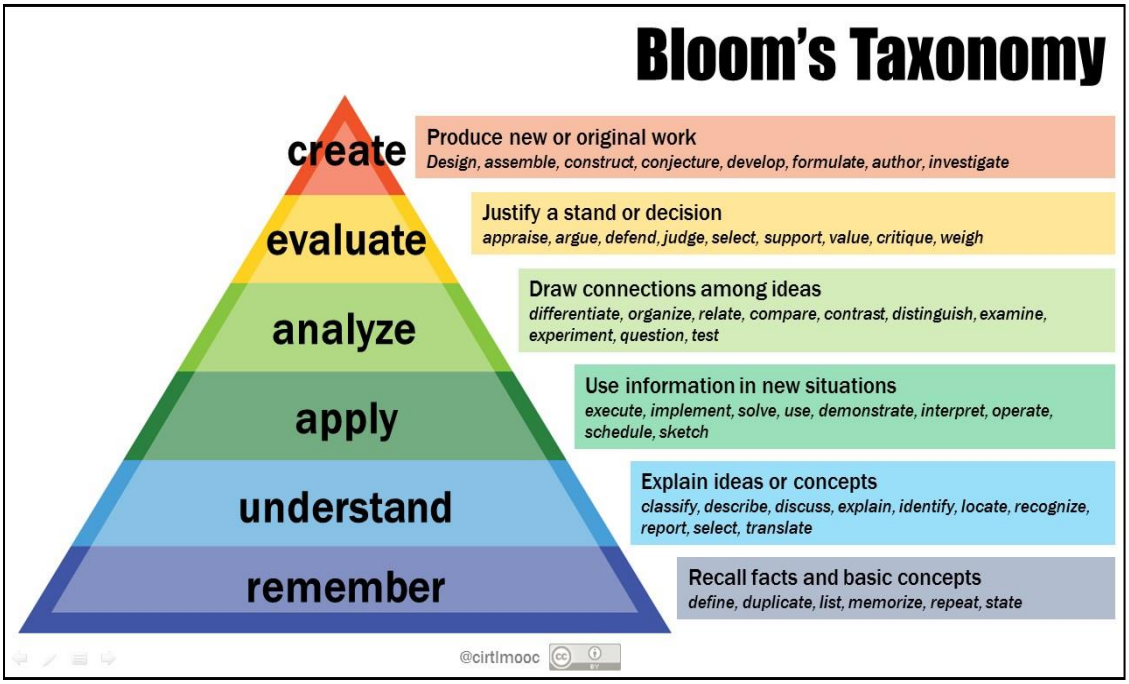
The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities

relevant to the professional engineering practice.
Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

APPENDIX C

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of **assessments** (tests and other evaluations of student learning), **curriculum** (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies. **[eduglosarry.org]**


Bloom's Taxonomy
create
Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate
evaluate
Justify a stand or decision
appraise, argue, defend, judge, select, support, value, critique, weigh
analyze
Draw connections among ideas
differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test
apply
Use information in new situations
execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch
understand
Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate
remember
Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state
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