

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Coimbatore – 641 032

B.E. CIVIL ENGINEERING



Curriculum & Syllabus

2017-2018

CHOICE BASED CREDIT SYSTEM

**HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING**

VISION OF THE INSTITUTE

IV: To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values

MISSION OF THE INSTITUTE

IM1: To provide academic excellence in technical education through novel teaching methods

IM2: To empower students with creative skills and leadership qualities

IM3: To produce dedicated professionals with social responsibility

**HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING**

VISION OF THE DEPARTMENT

DV: To be recognized globally for pre-eminence in Civil Engineering education, research and service

MISSION OF THE DEPARTMENT

DM1: To impart scientific and technical knowledge for professional practice, advanced study and research in Civil Engineering

DM2: To equip the students with ingenious leadership and organizational skills for a successful professional career

DM3: To inculcate professional and ethical responsibilities related to industry, society and environment

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The graduates will be able to:

PEO1: Excel as practicing engineers, academicians and researchers with a comprehensive knowledge in Civil Engineering

PEO2: Play a significant role as team players and leaders in challenging environments for nation's infrastructure development, environmental protection and sustainability

PEO3: Uphold professional and ethical responsibilities as engineers, consultants and entrepreneurs while addressing the demands of the society

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The graduates will be able to:

PSO1: Apply their engineering knowledge, communication skills, professional and ethical principles to solve problems in civil engineering and contribute to the infrastructure development in a sustainable way

PSO2: Use their engineering background to excel in competitive exams for advanced study, research and professional career

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DEPARTMENT OF CIVIL ENGINEERING

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- 3. Design / development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
- 12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

CURRICULUM

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. CIVIL ENGINEERING (UG)

REGULATION-2016

For the students admitted during the academic year 2017-2018 and onwards

SEMESTER I

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16MA1101	Engineering Mathematics-I	3	1	0	4	25	75	100
2	16PH1101	Engineering Physics	3	0	0	3	25	75	100
3	16CY1101	Engineering Chemistry	3	0	0	3	25	75	100
4	16HE1101R	Essential English for Engineers – I	3	1	0	4	25	75	100
5	16GE1101	Computer programming	3	0	0	3	25	75	100
6	16GE1102	Engineering Graphics	2	0	4	4	25	75	100
7	16PS1001	Physical Sciences Lab – I	0	0	2	1	50	50	100
8	16GE1001	Computer programming lab	0	0	4	2	50	50	100
9	16GE1002	Engineering Practices Laboratory	0	0	4	2	50	50	100
10	16GE1003	Value Added Course I : Language Competency Enhancement Course-I	0	0	2	1	0	100	100
		TOTAL CREDITS	17	2	16	27	300	700	1000



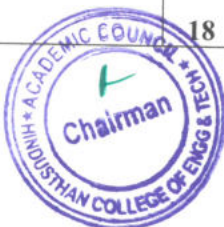
SEMESTER II

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16MA2102	Engineering Mathematics-II	3	1	0	4	25	75	100
2	16PH2102	Physics of Materials	3	0	0	3	25	75	100
3	16CY2103	Chemistry for Civil Engineering	3	0	0	3	25	75	100
4	16HE2102R	Essential English for Engineers - II	3	1	0	4	25	75	100
5	16GE2101	Engineering Mechanics	3	1	0	4	25	75	100
6	16EE2202	Basics of Electrical and Electronics Engineering	3	0	0	3	25	75	100
7	16PS2001	Physical Sciences Lab – II	0	0	2	1	50	50	100
8	16CE2001	Computer Aided Drawing Lab	0	0	4	2	50	50	100
9	16GE2001	Value Added Course II : Language Competency Enhancement Course-II	0	0	2	1	0	100	100
		TOTAL CREDITS	18	3	8	25	250	650	900

For the students admitted during the academic year 2016-2017 and onwards

SEMESTER III

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16MA3104	Fourier Analysis and Numerical Methods	3	0	0	3	25	75	100
2	16CE3201	Mechanics of Solids	3	1	0	4	25	75	100
3	16CE3202	Mechanics of Fluids	3	0	0	3	25	75	100
4	16CE3203	Construction Materials, Equipment & Practices	3	0	0	3	25	75	100
5	16CE3204	Surveying I	3	0	0	3	25	75	100
6	16CE3205	Environmental Science and Engineering	3	0	0	3	25	75	100
7	16CE3001	Survey Lab	0	0	4	2	50	50	100
8	16CE3002	Computer Aided Building Drawing	0	0	4	2	50	50	100
		TOTAL CREDITS	18	1	8	23	250	550	800



SEMESTER IV


S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	16MA4110	Applied Probability and Statistics	3	1	0	3	25	75	100
2	16CE4201	Strength of Materials	3	1	0	4	25	75	100
3	16CE4202	Applied Hydraulics and Hydraulic Machinery	3	0	0	3	25	75	100
4	16CE4203	Soil Mechanics	3	0	0	3	25	75	100
5	16CE4204	Surveying II	3	0	0	3	25	75	100
6	16CE4205	Highway & Railway Engineering	3	0	0	3	25	75	100
7	16CE4001	Strength of Materials Lab	0	0	4	2	50	50	100
8	16CE4002	Fluid Mechanics and Hydraulic Machinery Lab	0	0	4	2	50	50	100
		TOTAL CREDITS	18	2	8	23	250	550	800

CREDIT DISTRIBUTION

REGULATION-2016

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	23	23	24	23	25	17	187


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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4001	STRENGTH OF MATERIALS LAB	0	0	4	2

- Course Objective**
1. Understand the mechanical properties of materials used in construction.
 2. Study the behavior of metals under the action of various forces.
 3. Learn the various test procedures carried out on cement, bricks, metals and timber.

Expt . No. Description of the Experiment

1. Tension test on mild steel rod and aluminum rod.
2. Torsion test on mild steel rod.
3. Double shear test on mild steel rod and aluminum rod.
4. Impact test on metal specimens (Izod and Charpy)
5. Rockwell hardness test on metals.
6. Brinell hardness test on metals.
7. Deflection test on metal beam.
8. Test on helical spring.
9. Compressive test on wooden cube (Parallel and Perpendicular)
10. Compressive test on brick
11. Normal Consistency test of cement.
12. Fineness of cement.
13. Setting time of cement.
14. Soundness test on cement.
15. Specific gravity of cement.

Total Practical Hours 45

- Course Outcome**
- CO1. Determine the tensile, torsion, shear strength, hardness and impact values of metal specimens.
 - CO2. Carry out deflection test on metal beams.
 - CO3. Conduct experiments to calculate the compression strength of timber and bricks.
 - CO4. Assess the various physical and mechanical properties of cement.
 - CO5. Evaluate and justify the suitability of construction materials based on test results.

REFERENCE BOOKS:

- R1- Strength of Materials Laboratory Manual, Anna University, Chennai – 600 025.
- R2- IS 1786-2008, Specification for cold worked steel high strength deformed bars for concrete reinforcement, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4205	HIGHWAY AND RAILWAY ENGINEERING	3	0	0	3

- Course Objective**
- To familiarize the concepts of highway planning and geometric design of highway.
 - To learn the design of pavements.
 - To get exposed to various highway materials and testing, maintenance and pavement evaluation.
 - To know the importance of proper planning, designing and signaling of railways.
 - To understand the necessity of railway maintenance and modernization of tracks.

Unit	Description	Instructional Hours
I	HIGHWAY PLANNING AND ALIGNMENT Historical Development of Road Construction – Highway Development in India – Institutions for Highway Development at National Level – Requirements and Factors Affecting of Ideal Road Alignment – Engineering Survey for Alignment(Conventional & Modern Methods) – Classification of Roads – Highway cross sectional elements – Sight Distance – Design of Horizontal Alignments – Super elevation, Widening of pavements on horizontal curves – Transition Curves – Design of Vertical Alignments – Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves.	9
II	PAVEMENT DESIGN AND HIGHWAY CONSTRUCTION Rigid and Flexible Pavements – Components and their functions – Design principles of Flexible and Rigid Pavements, Factors affecting the Design of Pavements – ESWL, Climate, Sub-grade Soil and Traffic – Design Practice for Flexible and Rigid Pavements (CBR Method, IRC Method and Recommendations – Problems) –Joints.	9
III	HIGHWAY MATERIALS, MAINTENANCE AND REHABILITATION Desirable Properties and Testing of Highway Materials – CBR Test, Field Density Test – Aggregate – Crushing, Abrasion, Impact Tests, Water Absorption, Flakiness and Elongation Indices – Bitumen – Penetration, Ductility, Viscosity, Binder Content and Softening Point Test – Construction Practices – Water Bound Macadam Road, Wet mix macadam road Bituminous Road and Cement Concrete Road – Pavement distress in Flexible and Rigid Pavements – Symptoms, Causes and Treatments – Special Repairs – Highway Drainage – Pavement Evaluation – Pavement Strengthening – Overlay design by Benkelman Beam Method(Procedure Only).	9
IV	RAILWAY PLANNING AND DESIGN Role of Indian Railways in Development of Nation – Engineering Surveys for track alignment – Conventional and modern methods (Remote Sensing, GIS & GPS etc) – Elements of permanent way – Rails, sleepers, Ballast, rail fixtures and fastenings – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods – Geometric design of railways, gradient, super elevation, widening of gauge on curves – Points and Crossings.	10
V	RAILWAY CONSTRUCTION AND MAINTENANCE Earth work – Stabilization of track on poor soil – Tunneling methods, drainage and ventilation – Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construction & maintenances – Railway stations and yards and passenger amenities – Urban rail – Infrastructure for Metro, Mono and underground railways – Introduction of hyper loop.	8
Total Instructional Hours		45

- Course Outcome**
- Upon successful completion of the course, students shall have ability to
- Understand different highway development programs, sight distance and IRC recommendations.
 - Design the flexible and rigid pavements by IRC method.
 - Identify and explain the various highway materials and pavement evaluation methods.
 - Plan and design of railway tracks.
 - Demonstrate the need for modernization of tracks for speed trains.

TEXT BOOKS:

- T1- S K Khanna and C E G Justo, "Highway Engineering", Nem Chand and Brothers, Roorkee, 2015
T2- SaxenaSubhash C and Satyapal Arora, "A Text book of Railway Engineering", Dhanpat Rai

REFERENCE BOOKS:

- R1- S.P. Bindra, " Highway Engineering", Dhanpat Rai and Sons, Delhi,2014.
R2- L R Kadiyali, Principles and Practice of Highway Engineering, Khanna Publishers, Delhi,2005.
R3- G.V. Rao , "Principles of Transportation Engineering",Tata McGraw Hill Publication,2017

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4204	SURVEYING II	3	0	0	3

- Course Objective**
1. To understand the fundamentals of Control Surveying
 2. To be conversant with the precautionary measures and corrections in surveying.
 3. To learn the principles of Curve ranging
 4. To acquire knowledge on working principle of EDM and Total Station
 5. To study the principles of GPS and GIS and gain knowledge on aerial photography

Unit	Description	Instructional Hours
CONTROL SURVEYING		
I	Vertical and horizontal control-Triangulation – Different Networks, Orders and Accuracies. Signals and Towers, Trilateration, Base line-Instruments and Accessories- Corrections-Satellite stations- Reduction to centre-Trigonometric leveling-Single and reciprocal observations.	9
SURVEY ADJUSTMENTS		
II	Errors-Sources, Precautions and corrections-Classification of errors-true and most probable values- Weighted observations- Method of equal shifts-Principle of least squares-Level nets-Normal equations-Correlates.	9
CURVES		
III	Introduction - Curve ranging - Horizontal and vertical curves - Simple curves - Setting with chain and tapes, tangential angles by theodolite, double theodolite – Compound curves - Transition curves - Functions and requirements - Setting out by offsets and angles - Vertical curves - Sight distances.	9
ELECTRONIC DISTANCE MEASUREMENTS		
IV	Measurement principle of EDM instrument – EDM instrument characteristics – Accuracy in EDM – Field procedure of EDM – Total station – Introduction – Advantages – Types of total stations – Applications of total station - Sources of Error - Care and maintenance of Total Station instruments	9
GEOGRAPHICAL INFORMATION SYSTEM		
V	Introduction – Maps – Map projections – Map analysis – GIS – Definition – Basic components of GIS - Standard GIS softwares – Data types – Spatial and non-spatial (attributed) data – Measurement scales – Data Base Management Systems (DBMS).	9
Total Instructional Hours		45


- Course Outcome**
- Upon successful completion of the course, students will have ability to
- CO1 - Employ various types of Control Surveying.
 - CO2 - Take suitable precautions and apply necessary corrections in surveying.
 - CO3 - Interpret and plot simple, compound and transition curves
 - CO4 - Apply principles of EDM and use total station in surveying
 - CO5 - Plot and analyze the profile of various Photogrammetric mechanisms.

TEXT BOOKS:

- T1 - Duggal S.K., "Surveying", Vol. I & II, Tata McGraw-Hill, Publishing Company, 2017.
- T2 - Punmia.B.C., "Surveying Volume-1 & Volume-2", "Laxmi Publications(p)Ltd., 2016.

REFERENCE BOOKS:

- R1 - Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 4th Edition. 2015.
- R2 - Guocheng Xu, "GPS Theory, Algorithms and Applications", Springer - Berlin, 2016.
- R3 - Kanetkar.T.P., and Kulkarni.S.V., —Surveying and leveling, Vol I & II, Pune Vidyarthi Griha, Prakashan, 2012.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4203	SOIL MECHANICS	3	0	0	3

- Course Objective**
1. Learn the soil classification and compaction behavior of soil.
 2. Study the concepts behind the effective stress, permeability and seepage of soil.
 3. Understand the concepts of stress distribution and settlement.
 4. Explore the principles of shear test and liquefaction.
 5. Gain knowledge on slope stability analysis, failure mechanism and protection measures.

Unit	Description	Instructional Hours
SOIL CLASSIFICATION AND COMPACTION		
I	Nature of soil - Soil formation - Soil water – phase relationship - Volume-weight relationships - Index properties of soils - BIS Classification system – Tests for specific gravity -Grain size distribution – Sieve analysis – Atterberg limits - Soil compaction – Theory, comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.	9
EFFECTIVE STRESS CONCEPTS AND PERMEABILITY		
II	Effective stress concepts in soils – quick sand condition - Critical hydraulic gradient - Permeability measurement in the laboratory – Constant head and Variable head method - factors influencing permeability of soils - Seepage – introduction to flow nets – properties and uses of flow nets - Equipotential and flow lines - Simple problems.	9
STRESS DISTRIBUTION AND SETTLEMENT		
III	Stress distribution - soil media – Boussinesq equation – point load and line load - Westergaard's equation - Components of settlement – immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – computation of rate of settlement - \sqrt{t} and $\log t$ methods - Factors influencing compression behavior of soils.	9
SHEAR STRENGTH		
IV	Shear strength of cohesive and cohesion less soils – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – cyclic mobility – Liquefaction.	9
SLOPE STABILITY		
V	Slope failure mechanisms – Types of slope failure – stability analysis for cohesive and cohesion less soil - Friction circle method – Method of slices - Use of stability number - slope protection measures.	9
Total Instructional Hours		45

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Classify the soil based on index properties of soil.

CO2: Assess the permeability characteristics of soil and calculate stress at any point in soil media due to load applied at a ground surface.

CO3: Identify the stress distribution in soil, settlement problems occur in construction site.

CO4: Apply the knowledge in carrying out soil testing.

CO5: Analyze the stability of slope in cohesive and cohesion less soil by using different methods.

TEXT BOOKS:

T1-Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2015.


T2- Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi, 2011.

REFERENCE BOOKS:

R1 –Purusothamaraj.P "Soil mechanics and Foundation Engineering" 2nd Edition, Pearson Education, 2013.

R2 - Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2017.

R3 - Palanikumar. M, "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Leaning Private Limited, Delhi, 2013.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4202	APPLIED HYDRAULICS AND HYDRAULIC MACHINERY	3	0	0	3

- Course Objective**
1. To understand the types and flow regimes of open channel flows.
 2. To get acquainted with velocity measurements and determine the most economical channel sections.
 3. To acquire knowledge on the concepts of varied flow and learn the characteristics of hydraulic jump.
 4. To learn the various types of turbines and calculate the work done by each.
 5. To study the different types of pumps and their performance.

Unit	Description	Instructional Hours
OPEN CHANNEL FLOW		
I	Open channel flow - Types and regimes of flow - Velocity distribution in open channel - Wide open channel - Specific energy - Critical flow and its computation - channel transition.	8
UNIFORM FLOW		
II	Uniform flow - Velocity measurement - Manning's and Chezy's formula - Determination of roughness coefficients - Determination of normal depth and velocity - Most economical sections - Non-erodible channels.	8
VARIED FLOW		
III	Dynamic equations of gradually varied flow - Assumptions - Characteristics of flow profiles - Draw down and back water curves - Profile determination - Graphical integration, direct step and standard step method - Flow through transitions - Hydraulic jump - Types - Energy dissipation - Surges.	9
TURBINES		
IV	Impact of Jet on vanes - Turbines - Classification - Velocity triangle - Governing and selection of turbine - Reaction turbines - Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbine - Performance of turbine - Specific speed - Similarity laws.	10
PUMPS		
V	Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps: Gear pump.	10
Total Instructional Hours		45

Course Outcome

Upon successful completion of the course, students will have ability to

CO1: Classify open channel flows and plot the flow regimes.
CO2: Design the most economical sections for open channel flows.
CO3: Analyse varied flows and interpret hydraulic jump phenomenon.
CO4: Assess the performance of various types of turbines.
CO5: Estimate the efficiency of different pumps.

TEXT BOOKS:

- T1 - Chandramouli 'Applied Hydraulics' YesDee Publishers, 2017
T2 - R.K.Rajput., "A text Book of Fluid Mechanics", S.Chand and Company, New Delhi, 2009.

REFERENCE BOOKS:

- R1 - Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2011.
R2- Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi, 2008.
R3 - Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE4201	STRENGTH OF MATERIALS	3	1	0	4

- Course Objective**
1. To know the concepts of truss analysis.
 2. To gain knowledge on the analysis of thin and thick cylinders subjected to fluid pressure and various failure theories.
 3. To study the behaviour of short and long column under axial and eccentric loads.
 4. To understand the deflection of beams by various methods.
 5. To get exposed to the principles of unsymmetrical bending and shear.

Unit	Description	Instructional Hours
	ANALYSIS OF TRUSSES	
I	Perfect, deficient and redundant trusses - Degree of redundancy – Internal and external redundancy – Methods of analysis - Method of joints - Method of sections - Method of tension coefficients - Analysis of Space Truss.	9+3
	THIN AND THICK CYLINDERS AND THEORIES OF ELASTIC FAILURE	
II	Thin cylinders – Circumferential stress – Longitudinal stress – Volumetric strain - Stresses in thick cylindrical shell– Lamé’s equation – Stresses in compound cylinders – Shrink fit - Failure theories - Maximum principal stress theory- Maximum shear stress theory- Maximum principal strain theory- Strain energy theory- maximum shear strain energy theory.	9+3
	COLUMNS AND STRUTS	
III	Short and slender columns- Axial and bending stress – Kern of a section - buckling and stability – Columns with pinned ends - Columns with other support conditions - Columns with eccentric loads - Euler theory and Rankine’s formula - Elastic and inelastic column behaviour – Design formulae for columns.	9+3
	DEFLECTION OF BEAMS	
IV	Deflection of beams - Geometric methods - Double integration method – Macaulay’s method – Moment-Area method - Conjugate beam method.	9+3
	UNSYMMETRICAL BENDING	
V	Unsymmetrical bending- Symmetrical and unsymmetrical sections - Bending stresses in beams - Shear centre - Shear centre for thin walled beam of mono- Symmetric and unsymmetrical open sections.	9+3
	Total Instructional Hours	45+15=60

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Analyse the determinate trusses.
CO2: Evaluate the problems related to thin and thick cylinders subjected to fluid pressure.
CO3: Interpret the behaviour of short and long column under axial and eccentric loads.
CO4: Determine slope and deflection in beams using various methods.
CO5: Apply the concepts in beams subjected to unsymmetrical bending.

TEXT BOOKS:

T1-Rajput R.K. “Strength of Materials (Mechanics of Solids)”, S.Chand&Company Ltd., New Delhi, 2015.

T-2 Egor P Popov, “Engineering Mechanics of Solids”, 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1- Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co., New Delhi, 2006.

R2- PunmiaB.C. “Theory of Structures” (SMTS) Vol I&II, Laxmi Publishing Pvt. Ltd., New Delhi 2018.

R3- Srinath, L.S, “Advanced Mechanics and solids”, Tata-McGraw Hill publishing company Ltd, 2008.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA4110	APPLIED PROBABILITY AND STATISTICS (B.E CIVIL)	3	1	0	3

Course Objective

1. Provide the fundamental knowledge of the concepts of probability.
2. Express the knowledge of standard distributions which can describe real life phenomenon.
3. Interpret mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.
4. Provide the necessary basic concepts of some statistical methods.
5. Manipulate different kinds of problems occurring in engineering and technology by applying the design of experiments.

Unit	Description	Instructional Hours
	PROBABILITY AND RANDOM VARIABLE	
I	Introduction - Conditional probability- Total probability- Baye's theorem(proof excluded) - Random variable - Discrete and Continuous random variables- Moment generating functions.	9
	STANDARD DISTRIBUTIONS	
II	Discrete distributions – Binomial, Poisson, Geometric distributions – Continuous distributions – Uniform, exponential and Normal distributions.	9
	TWO DIMENSIONAL RANDOM VARIABLES	
III	Joint distributions – discrete and continuous random variables - Marginal and Conditional probability distributions – Covariance – Correlation.	9
	TESTING OF HYPOTHESIS	
IV	Large sample test based on Normal distribution for single mean and difference of means, Tests based on t (single mean and difference of means) - Chi-Square test- Goodness of fit.	9
	DESIGN OF EXPERIMENTS (ANOVA)	
V	One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design.	9
	Total Instructional Hours	45

Course Outcome

CO1: Have a fundamental knowledge of the probability concepts.
CO2: Acquire knowledge of standard distributions.
CO3: Understand the concept of two dimensional random variables, Correlation.
CO4: Acquire skills in analyzing statistical methods.
CO5: Have a clear perception of the statistical ideas and demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

T1 - Gupta, S.C., & Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, Reprint 2011
T2 - Veerarajan.T," Probability, Statistics and Random Process",Tata McGraw Hill,2nd Edition,New Delhi, 2010

REFERENCE BOOKS :

R1-Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
R2 -Walpole. R.E., Myers. R.H., Myers. S.L., & Ye K., "Probability & Statistics for Engineers & Scientists", 8th Edition, Pearson Education, Asia, 2007.
R3 -Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3002	COMPUTER AIDED BUILDING DRAWING	0	0	4	2

Course Objective

1. To review the basic commands options and elements of AutoCAD.
2. To read and understand the plan, elevation, cross section and joinery details of a building
3. To learn how to draw the various types of masonry, concrete and steel structures using AutoCAD.

Expt . No.	Description of the Experiment
1.	Masonry bonds and its types
2.	Principles of planning, dimensions and orientation of buildings as per NBC guidelines
3.	Joinery details (Paneled and Glazed Doors and Windows)
4.	Buildings with load bearing walls
5.	Buildings with sloping roof
6.	R.C.C. framed structures
7.	Industrial buildings – North light roof structures
8.	Building Information Modeling

Total Practical Hours

45

Course Outcome

Upon successful completion of the course, students will have ability to

CO1: Draft the plan, elevation and cross-sectional views of various kinds of structures using computer applications.

CO2: Incorporate the principles of planning and orientation while plotting the layout of a building.

CO3: Sketch and label the various components of buildings and joinery details using AutoCAD.

CO4: Prepare detailed layouts of RCC and steel structures in accordance to NBC guidelines.

CO5: Efficiently plan and design buildings using BIM process.

TEXT BOOKS:

- T1 - Sikka V. B., A Course in Civil Engineering Drawing, 4th Edition, S.K. Kataria and Sons, 2015.
T2 - George Omura, "Mastering in AUTOCAD 2002", BPB Publications, 2002.

REFERENCE BOOKS:

- R1 -Shah. M.G., Kale. C.M. and Patki. S.Y., "Building Drawing with an Integrated Approach to Built Environment", Tata McGraw Hill Publishers Limited, 2011.
R2 - Verma.B.P., "Civil Engineering Drawing and House Planning", Khanna Publishers, 2006.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3001	SURVEY LAB	0	0	4	2

Course Objective	
	1. To gain knowledge on the principles and usage of chains and its accessories.
	2. To learn how to use compass.
	3. To study the methods and operational techniques of levels and theodolite.

Expt . No.	Description of the Experiment	
1.	Study of chains and its accessories	
2.	Aligning, Ranging and Chaining	
3.	Chain Traversing	
4.	Compass Traversing	
5.	Fly leveling using Dumpy level	
6.	LS and CS	
7.	Study of Theodolite	
8.	Horizontal angle by the method of repetition	
9.	Horizontal angle by the method of reiteration	
10.	Measurement of vertical angle	
11.	Theodolite traverse	
Total Practical Hours		45

Course Outcome	
	Upon successful completion of the course, students will have ability to
	CO1: Handle and operate the conventional surveying instruments such as chain and tape to measure distances and areas.
	CO2: Conduct traversing experiment using compass, and theodolite to calculate the given area.
	CO3: Interpolate and plot LS, CS and Contour using levels.
	CO4: Use the theodolite effectively to determine the horizontal and vertical angles.
	CO5: Take measurements, adjust the errors and prepare a layout of a given area

REFERENCE BOOKS:

- R1 - James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, 7th Edition, McGraw Hill, 2001.
R2 - Arora K.R., Surveying Vol I & II, Standard Book house , 10th Edition 2010
R3 - Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2011.

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TEXT BOOKS:

T1 -Deeksha Dave, S. S. Katewa., "Text Book of Environmental Studies", 2nd edition, Cengage Learning India Pvt. Ltd., Delhi , 2012.

T2 -Anubha Kaushik and C.P.Kaushik, "Environmental Science and Engineering", 3rd Edn New age International Publishers, New Delhi , 2008.

REFERENCE BOOKS:

R1 - R.K.Trivedi, "Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards", Vol.I &II, Environ Media., 2008.

R2 - G.Tyler Miller,JR, "Environmental Science", Tenth Edition, Thomson BROOKS/COLE ,2014.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3205	ENVIRONMENTAL SCIENCE AND ENGINEERING	3	0	0	3

- Course Objective**
- To learn the concepts of ecosystem and inculcate a sense of responsibility in protecting our ecosystems.
 - To understand the natural resources.
 - To study the causes, effects and control measures of environmental pollution.
 - To gain the basic knowledge on social issues and the environment.
 - To emphasize the relationship between human population and the environment.

Unit	Description	Instructional Hours
I	<p>ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY</p> <p>Environment - Definition, importance, components - concept of an ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – food chains, food webs and ecological pyramids – Biogeochemical cycles - Types, Characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, lakes, rivers, oceans, estuaries) – Ecological succession - Introduction to biodiversity - definition: genetic, species and ecosystem diversity – values and importance of biodiversity - hotspots of biodiversity - biogeographical classification of India – endangered and endemic species - threats to biodiversity – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.</p>	12
II	<p>NATURAL RESOURCES</p> <p>Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction– Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, soil erosion and desertification – role of an individual in conservation of natural resources.</p>	10
III	<p>ENVIRONMENTAL POLLUTION</p> <p>Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Thermal pollution (f) Radioactive pollution – Solid waste Management– role of an individual in prevention of pollution – pollution case studies.</p>	8
IV	<p>SOCIAL ISSUES AND THE ENVIRONMENT</p> <p>From unsustainable to sustainable development – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization - environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion– wasteland reclamation – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards.</p>	8
V	<p>HUMAN POPULATION AND THE ENVIRONMENT</p> <p>Population growth – population explosion – family welfare programme – Women and Child welfare - human rights – value education – HIV / AIDS – Environmental Impact Assessment - role of information technology in environment and human health – Case studies.</p>	7
Total Instructional Hours		45

- Course Outcome**
- Upon successful completion of the course, students will have ability to
- CO1: Predict the implications of anthropogenic activities on ecosystems and protect biodiversity.
 - CO2: Appreciate the values of natural resources and develop measures for restoration.
 - CO3: Devise means and methods for pollution prevention and control.
 - CO4: Illustrate the social issues and also have a thorough understanding of the environmental legislations.
 - CO5: Integrate human health and environment and compile environmental data using IT.

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Programme	CourseCode	Name of the Course	L	T	P	C
B.E.	16CE3204	SURVEYING –I	3	0	0	3
Course Objective	<ol style="list-style-type: none"> To gain knowledge on basic principle and concepts of different surveying methods. To learn how to use compass to carryout land surveying. To learn the basics of leveling and its applications. To explore the principles for computation of areas using different methods. To understand the concepts of Theodolite survey in linear and angular measurements. 					
Unit	Description					Instructional Hours
	INTRODUCTION AND CHAIN SURVEYING					
I	INTRODUCTION: Definition, objectives, principles and classification of surveying – Plan and map. Overview of Plane surveying (chain and compass), Objectives - Well conditioned triangles CHAIN SURVEYING: Linear measurements - Direct measurement – Ranging – offsets - errors in chaining-cross staff and optical square - obstacles in chaining - Problems - Traversing - plotting–Sources and limits of error and their correction.					9
II	COMPASS SURVEYING Introduction, Meridians and bearings, Principle, working and use of Prismatic compass, Surveyor's compass. Dip and Declination, Traverse surveying, Computation of bearings and included angles given the bearings of legs of a closed traverse. Local attraction, determination and corrections.					9
III	LEVELLING Levelling Instruments – Spirit Level – Sensitiveness – Bench Marks – Temporary and Permanent Adjustments – Differential, Fly, Check, Profile and Block Levelling – Booking - Rise and fall method and Height of Instrument method, comparison of Arithmetic checks - Reduction-CONTOURING: Definition of contour – Contour interval – Characteristics of contours – Direct and indirect methods of contouring – Applications of contour maps.					9
IV	COMPUTATION OF AREAS AND VOLUMES Area from field notes and from plan by dividing into triangles, square etc. computation of areas along boundaries using Simpon's rule, and their comparison, computation of areas using planimeter, construction and working of planimeter. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.					9
V	THEODOLITE SURVEYING Theodolite - vernier and micro-optic - description and uses - temporary and permanent adjustments - horizontal - vertical angles - heights and distances - Tangential and Stadia Tacheometry – Subtense method - Stadia constants - traversing - closing error and distribution - Gale's table - omitted measurements.					9
Total Instructional Hours						45
Course Outcome	Upon successful completion of the course, students will have ability to CO1: Carryout preliminary surveying to prepare a layout of a given area. CO2: Apply compass surveying and compute bearings. CO3: Plot LS, CS and Contouring using leveling applications. CO4: Compute the areas and distances using linear methods. CO5: Apply the methods of measurement by heights and distances using tacheometry surveying.					

TEXT BOOKS:

- T1 - Punmia, B. C., "Surveying", Vol.1, Laxmi Publications, New Delhi. 2015
 T2 - Chandra A.M., "Plane Surveying", New Age International Publishers, 2015.

REFERENCE BOOKS:

- R1 - Alak De, "Plane Surveying", S. Chand & Company Ltd., 2000.
 R2 - Bannister and S. Raymond, R. Baker "Surveying", 7th Edition, Pearson Education Ltd., 2009.
 R3 - Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2010.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3203	CONSTRUCTION MATERIALS, EQUIPMENT AND PRACTICES	3	0	0	3

- Course Objective**
- To familiarize the materials used in construction and their testing methods.
 - To study the properties of ingredients of concrete and its behavior in fresh and hardened state
 - To learn the codal provisions, construction and safety practices in construction industry.
 - To gain knowledge of super structure and sub structure construction methods and techniques.
 - To understand the application of various construction equipment.

Unit	Description	Instructional Hours
CONSTRUCTION MATERIALS		
I	Classification of rocks, Bricks – Manufacturing –Types – Uses - Properties – Building stones – Types – Uses - Tests on stones, Preservation of stones - Properties – Cement – Manufacturing, Types, Uses and Properties – Tests on Cement – Timber –Seasoning, Defects and application of timber – Plywood, Steel – Structural steel – Glass – Types and Uses – Paints – Constituents, Types and Uses.	9
CONCRETE TECHNOLOGY		
II	Concrete – Ingredients of concrete –Admixtures – Types & Uses – Batching – Mixing – Placing – Compacting – Curing – Properties of concrete – Segregation & Bleeding – Tests on Fresh and Hardened Concrete – Mix Design – BIS Method.	9
CONSTRUCTION PRACTICES AND SAFETY		
III	Loads acting on buildings – Site Clearance – Marking – Earthwork - Masonry – Stone and Brick – Flooring – Damp Proof Courses - Construction joints – Types – Building Foundations and Basements - Formwork and scaffolding – Slip form technology – Construction Safety- Personal Protective Equipment (PPE) – Electrical Safety – Fire Prevention and Control – Safety Signs and Signals – Excavations and Confined Spaces.	9
SUB STRUCTURE AND SUPER STRUCTURE CONSTRUCTION		
IV	Box jacking – Piling techniques – Tunnel driving – Cofferdam – Cable anchoring and methods in grouting – well point system and dewatering techniques – under water construction of diaphragm walls and basement – Tall structures – Chimneys, cooling towers, electric towers – Erection of articulated structures – Braced domes and space decks – Bridges and types – Construction methods and techniques using in-situ concrete and precast concrete.	9
CONSTRUCTION EQUIPMENTS		
V	Selection of Equipment for Earthwork – Earth Moving Operations – Types of Earthwork equipment – Tractors, Motor Graders, Scrapers, Front End Waders, Earth Movers – Equipment for Foundation and Pile Driving – Equipment for Compaction, Batching, Mixing and Concreting – Equipment for Material Handling and Erection of Structures – Equipment for Dredging, Trenching and Tunneling.	9
Total Instructional Hours		45

- Course Outcome**
- Upon successful completion of the course, students will have ability to
- CO1. Identify the typical and potential applications and properties of materials.
 - CO2. Test the concrete materials and determine the properties of fresh and hardened concrete.
 - CO3. Recognize codal provisions and incorporate safety practices in construction industry.
 - CO4. Plan the requirements for sub-structure and super-structure construction.
 - CO5. Enumerate the various equipments used in construction.

TEXT BOOKS:

- T1 - Shetty.M.S., "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd., 2008.
T2 -Arora S.P. and Brindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 2010.

REFERENCE BOOKS:

- R1 -Gambhir, M.L., Neha Jamwal" Building Materials – Products, Properties and Systems", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2013.
R2 -Duggal,S.K., "Building Materials", 4th Edition, New Age International, 2012.
R3- Sandeep Mantri, "Practical Building Construction and its Management", Satya Prakashan, New Delhi, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3202	MECHANICS OF FLUIDS	3	0	0	3
Course Objective	1. To understand the properties of fluids. 2. To learn the basic concepts of fluid statics and pressure measurements. 3. To acquire knowledge on the concepts of fluid kinematics and dynamics. 4. To understand the behavior of flow through pipes. 5. To gather knowledge on dimensional analysis.					
Unit	Description					Instructional Hours
	FLUID PROPERTIES					
I	Fluid – definition, distinction between solid and fluid - Properties of fluids - Density, Specific Weight, Specific Volume, Specific Gravity, Temperature, Viscosity, Compressibility, Vapour Pressure, Capillarity and Surface Tension.					9
	FLUID STATICS					
II	Pascal’s and Hydrostatic Law – Pressure measuring devices (simple manometers, differential manometers: U tube, inclined and Mechanical gauges), Centre of pressure, total pressure on plane -Forces on plane – Buoyancy - Metacentric height.					9
	FLUID KINEMATICS & FLUID DYNAMICS					
III	Types of fluid flow – Velocity and Acceleration –Continuity equation in Cartesian coordinates -Velocity potential function and Stream function- Flow net -Euler’s and Bernoulli’s equations – Application of Bernoulli’s equation – Orificemeter, Venturimeter. Measurement of Discharge – Momentum principle.					9
	FLOW THROUGH PIPES					
IV	Flow through pipes – Laminar flow through pipes and between plates – Hagen – Poiseuille equation – Turbulent flow- Major and minor losses of flow in pipes - Darcy Weisbach's equation - Moody's diagram –Flow through pipes in series and in parallel – Pipe networks - Hydraulic and energy gradient - Mouthpiece and orifice.					9
	DIMENSIONAL ANALYSIS					
V	Units and Dimensions – Dimensional homogeneity – Rayleigh’s method – Buckingham Pi theorem –Similitude – Dimensionless Numbers and their significance Model Laws-Types of Models.					9
	Total Instructional Hours					45
Course Outcome	Upon successful completion of the course, students shall have ability to CO1: Use fluid properties to design pipes to carry particular amount of discharge. CO2: Solve fluid statics problems and measure fluid pressure CO3: Distinguish between various types of fluid flows and find the fluid velocity and discharge using principles of Kinematics and Dynamics. CO4: Identify the laminar and turbulent flow through pipes and compute the energy losses in pipe flow. CO5: Select appropriate model to provide solution to a real time problem related to hydraulics.					

TEXT BOOKS:

T1 -Jain A.K., “Fluid Mechanics (including Hydraulic Machines)”, Khanna Publishers, 2010.
 T2 - Modi P.N. and Seth S.M., “Hydraulics and Fluid Mechanics including Hydraulic Machines”, Standard Book House, New Delhi, 2013.

REFERENCE BOOKS:

R1 -Pani B.S. “Fluid Mechanics: A concise introduction” PHI Learning EEE 2016
 R2-Ramamrutham,S., “Fluid Mechanics and Hydraulics and Fluid Machines”, Dhanpat Rai and Sons,Delhi,2014.
 R3 -Bansal R.K., “Fluid Mechanics & Hydraulic Machines”, Laxmi Publications, 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE3201	MECHANICS OF SOLIDS	3	1	0	4

- Course Objective**
1. To study the state of stresses and strains in structural components subjected to different loading conditions.
 2. To gain knowledge on shear force and bending moment for all statically determinate and indeterminate beams by recognizing the beam type and loading.
 3. To learn the concepts of internal stress in beams of various cross sections.
 4. To analyze the members under complex state of stress by means of analytical and graphical methods.
 5. To understand the behaviour of members subjected to pure torsion and shear.

Unit	Description	Instructional Hours
I	TENSION, COMPRESSION AND SHEAR Introduction - Stress and strain - Mechanical properties of materials - Elasticity, plasticity and creep - Linear elasticity- Hooke's law - Poisson's ratio - Elastic constants- Allowable stresses and allowable loads - Thermal stresses in compound bars -Impact loading.	9+3
II	SHEAR FORCE AND BENDING MOMENT Introduction - Types of beams, loads and reactions - Shear force and bending moment - Relationships between load, shear force and bending moment – Shear force and bending moment diagrams.	9+3
III	STRESSES IN BEAMS Introduction - Pure bending and non-uniform bending - Curvature of a beam - Longitudinal strains in beams - Normal stresses in beams – Non- prismatic beams - Shear stresses in beams of rectangular, circular, T and I section - Built-up beams and shear flow.	9+3
IV	PRINCIPAL STRESS AND STRAIN Plane stress - Principal stresses and maximum shear stress – Mohr's circle for plane stress - Determination of principal stresses and principal planes - plane strain - Applications of plane stress - Maximum stresses in beams-Spherical and deviator components of stress tensor.	9+3
V	TORSION OF SHAFTS AND SPRING Torsional deformations of a circular bar - Circular bars of linearly elastic materials – Non uniform torsion - Stresses and strains in pure shear - transmission of power by circular shafts - Stepped shafts - Shafts fixed at both ends - Strain energy in torsion and pure shear - Springs – Types- Helical and leaf springs – Stresses and deflection of springs.	9+3
Total Instructional Hours		45+15=60

Course Outcome

Upon successful completion of the course, students shall have ability to

CO1: Realize the state of stresses and strains in structural components under tension, compression and shear.

CO2: Plot the Shear force and bending moment diagrams for all the statically determinate and indeterminate beams.

CO3: Analyse the beam for internal stress.

CO4: Evaluate the elements subjected to complex state of stress by means of analytical and graphical methods

CO5: Comprehend the behaviour of members under pure torsion and shear.

TEXT BOOKS:

- T1-Bansal R.K. "Strength of materials", Laxmi Publications, New Delhi, 2012.
T2-Rajput.R.K."Strength of Materials", S.Chand and Co, New Delhi, 2015.

REFERENCE BOOKS:

- R1-William A. Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw-Hill publishing co., New Delhi, 2007.
R2-Ramamrutham, S., "Strength of Materials", DhanpatRai& Sons, 2014.
R3-Gambhir.M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA3104	FOURIER ANALYSIS AND NUMERICAL METHODS (COMMON TO CIVIL & MECHATRONICS)	3	0	0	3

Course Objective

1. Introduce Fourier series analysis which is central to many applications in engineering.
2. Solve boundary value problems by applying Fourier series.
3. Acquaint with Fourier transform techniques used in wide variety of situations.
4. Familiar with the concepts of numerical differentiation and numerical integration.
5. Find the numerical solution of ordinary differential equations as most of the engineering problems are expressed in the form of differential equations.

Unit	Description	Instructional Hours
	FOURIER SERIES	
I	Introduction - Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	9
	BOUNDARY VALUE PROBLEMS	
II	Classification – solution of one dimensional wave equation – one dimensional heat equation –Fourier series solution in Cartesian coordinates.	9
	FOURIER TRANSFORMS	
III	Fourier Transform Pair-Fourier sine and cosine transforms – Properties-Transforms of Simple functions – Convolution Theorem – Parseval's identity.	9
	NUMERICAL DIFFERENTIATION AND INTEGRATION	
IV	Differentiation using interpolation formula – Newton's forward and backward interpolation for equal intervals – Numerical integration by Trapezoidal and Simpson's 1/3 rule – Double integration using Trapezoidal and Simpson's rules.	9
	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	
V	Single step methods: Taylor's series method – Modified Euler's method for first order equation – Fourth order Runge- kutta method for solving first order equations – Multi step method: Milne's predictor and corrector method.	9

Total Instructional Hours 45

Course Outcome

CO1: Understand the mathematical principles of Fourier series which would provide them the ability to formulate and solve some of the physical problems of engineering.

CO2: Acquire the knowledge of application of Fourier series in solving the heat and wave equations.

CO3: Understand the mathematical principles on Fourier transforms and able to solve some of the physical problems of engineering..

CO4: Evaluate many numerical integration problems and appreciate their applications for engineering problem solving.

CO5: Obtain the knowledge of solving ordinary differential equations using single and multi step methods.

TEXT BOOKS:

T1 - Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd.,
Second reprint, New Delhi, 2012.

T2 - Grewal.B.S. "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, 2007.

REFERENCE BOOKS :

R1 - Kreyszig.E."Advanced Engineering Mathematics", Eight Edition, John Wiley & sons (Asia Ltd 2007.

R2 - Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S. Chand & Company Ltd., New Delhi, 2010.

R3 - Kandasamy P., Thilagavathy K. and Gunavathy K., "Numerical methods", S. Chand & Company Ltd., New Delhi, 2010.

R4- S.K.Gupta, Numerical Methods for Engineers", New Age International Pvt.Ltd Publishers,2015.

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE2001	VALUE ADDED COURSE – II: LANGUAGE COMPETENCY ENHANCEMENT COURSE- II (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective	Description
	<ul style="list-style-type: none"> ✓ To improve communication skills and Professional Grooming. ✓ To impart deeper knowledge of English Language and its practical application in different facets of life. ✓ To equip the techniques of GD, Public Speaking, debate etc.

Unit	Description	Instructional Hours
I	Listening Listening for gist and respond – Listen for detail using key words to extract specific meaning – listen for phonological detail – Listen and identify the main points for short explanations and presentation.	3
II	Reading Strategies for effective reading – read and recognize different text types – Genre and Organization of Ideas – Quantifying reading – reading to comprehend – Interpreting sentences – contrasting, summarizing or approximating	3
III	Speaking Speak to communicate – Make requests and ask questions to obtain personal information – use stress and intonation – articulate the sounds of English to make the meaning understood – speaking to present & Interact – opening and closing of speech.	3
IV	Writing Plan before writing – develop a paragraph: topic sentences, supporting sentences – write a descriptive paragraph – elements of good essay – descriptive, narrative, argumentative – writing emails – drafting resumes – project writing – convincing proposals.	3
V	Language Development Demonstration at level understanding of application of grammar rules – revision of common errors : preposition, tenses, conditional sentences –reference words – pronouns and conjunctions.	3
Total Instructional Hours		15

Course Outcome	Description
	CO1- Introduced to different modes and types of communication.
	CO2- Practiced to face and react to various professional situations efficiently.
	CO3- learnt to practice managerial skills.
	CO4- Familiarized with proper guidance to writing.
	CO5- Trained to analyze and respond to different types of communication.

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma, 9th edition, Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis, – Print, 1 June 2011.
3. High School English Grammar by Wren and Martin, S.CHAND Publications, 1 January 2017.
4. Practical course in Spoken English by J.K. Gangal, PHI Learning , Second edition, 1 January 2018.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CE2001	COMPUTER AIDED DRAWING LAB	0	0	4	2

Course Objective

- To develop skill to use software to create 2D Drawing.
- To provide students with the necessary knowledge in drafting skills.

- Study of capabilities of software for Drafting – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple geometries like polygon and general multi-line figures.
- Drawing of Curves like parabola, ellipse and spiral.
- Drawing of Involutés of circle, square and Pentagon.
- Drawing of a Title Block with necessary text and projection symbol.
- Drawing of Front view, Top view and Sectional Plan of simple solids like Prism, Pyramid, Cylinder, Cone and its dimensioning.
- Drawing of Isometric projections of simple objects.
- Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows)
- Drawing of a Plan and Elevation and Sectional view of Residential Building (Single bed room, kitchen, hall, etc.)
- Preparation of a Layout showing the Electrical Connections, Appliances and Fixtures in a Residential Building.
- Preparation of a Layout showing Plumbing Connections, Pipelines and Fixtures in a Residential Building.
- Drawing of Steel Trusses.

Total Practical Hours 45

Concepts and Conventions:

Understand draw panel and modify panel, line types, creating dimensions, hatching techniques, layer Creations, text styles, and template drawings, use of Blocks, Design Center, Tool Palettes and Plotting.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

Course Outcome

CO1.Ability to use the software packages for drafting
CO2.Ability to create 2D Drawing of Engineering Components
CO3. Apply basic concepts to develop construction drawing techniques

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS	
S. No	Description of Equipment Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility 30 Nos.
2.	Licensed software for Drafting-30 Licenses.
3.	Laser Printer or Plotter to print / plot drawings-2 Nos.


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Programme	CourseCode	Name of the Course	L	T	P	C
B.E.	16PS2001	PHYSICAL SCIENCES LAB - II CHEMISTRY LAB – II (COMMON TO ALL BRANCHES)	0	0	2	1

- Course Objective**
1. Acquire practical skills in the quantitative analysis of water quality parameters.
 2. Acquire practical skills in the instrumental methods for quantitative Estimation of metal ion content.
 3. Gain knowledge in determination of rate of corrosion.

Expt. No.	Description of the Experiments
1.	Determination of Dissolved Oxygen in water by Winkler's method.
2.	Estimation of alkalinity of water sample by indicator method.
3.	Estimation of hydrochloric acid by pH metry.
4.	Estimation of ferrous iron by Potentiometry.
5.	Estimation of Copper by EDTA
6.	Determination of sodium by flame photometry
7.	Determination of corrosion rate of mild steel by weight loss method.

Total Practical Hours

30

- Course Outcome**
- CO1: Determine the level of DO in a water sample.
CO2: Identify and estimate the different types of alkalinity in water sample.
CO3: Estimate the acidity of water sample using pH metry.
CO4: Estimate the amount of copper in a brass sample.
CO5: Determine the metal ion content using instrumental methods.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS2001	PHYSICAL SCIENCES LAB – II PHYSICS LAB II (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective


1. Evaluate the band gap of a semiconductor.
2. Apply the concept of interference and calculate the thickness of thin wire.
3. Acquire the practical skills in Young’s modulus by uniform bending method.

Expt. No.	Description of the Experiments
1.	Determination of Young’s modulus by uniform bending method
2.	Determination of band gap of a semiconductor
3.	Determination of Coefficient of viscosity of a liquid –Poiseuille’s method
4.	Determination of Dispersive power of a prism - Spectrometer
5.	Determination of thickness of a thin wire – Air wedge method
6.	Determination of Rigidity modulus – Torsion pendulum
7.	Magnetic hysteresis experiment.
8.	Calibration of ammeter using potentiometer

Total Practical Hours **30**

Course Outcome

CO: 1. Experiment involving the physical phenomena of the Rigidity modulus of wire.
CO: 2. Determine the band gap of a semiconductor and variation of Energy Gap (E_g)with temperature.
CO: 3 Assess the Young’s modulus of a beam using non uniform bending method.
CO: 4. Explain the concept of interference and calculate the thickness of thin wire and other fine objects.
CO:5. Experiment provides a unique opportunity to validate Dispersive power of a prism using Spectrometer.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16EE2202	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (COMMON TO AERO, AUTO, CIVIL, MECH & MECH)	3	0	0	3

- Course Objective**
- To apply the basic laws used in Electrical circuits and the different components.
 - To impart knowledge on construction and working of DC and AC machines
 - To provide knowledge on the fundamentals of semiconductor devices and their applications.
 - To impart knowledge on digital electronics and its principles.
 - To develop block diagrams for satellite and optical fiber communications.

Unit	Description	Instructional Hours
I	ELECTRICAL CIRCUITS AND MEASUREMENTS Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase circuits - Three Phase Balanced Circuits. Operating Principles of Moving Coil and Moving Iron Instruments - Ammeters and Voltmeters. Dynamometer type Watt meters and Energy meters.	9
II	ELECTRICAL MACHINES Construction, Principle of Operation of DC Generators - EMF Equation - Construction, Principle of Operation of DC shunt and series Motors, Single Phase Transformer - EMF Equation, Single phase capacitor start - capacitor run – Construction, Principle of Operation of Three Phase Induction Motor – Applications - (Qualitative Approach only).	9
III	SEMICONDUCTOR DEVICES AND APPLICATIONS Characteristics of PN Junction Diode – Zener Diode and its Characteristics – Zener Effect – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor (BJT) – CB, CE, CC Configurations and Characteristics – FET – Characteristics.	9
IV	DIGITAL ELECTRONICS Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops (RS, JK, T & D), A/D and D/A Conversion (Dual Slope, SAR, Binary-weighted and R-2R).	9
V	FUNDAMENTALS OF COMMUNICATION ENGINEERING Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations - Satellite and Optical Fibre communications (Block Diagram Approach only).	9
TOTAL INSTRUCTIONAL HOURS		45

- COURSE OUTCOME**
- At the end of this Course, students will be able to:
- Apply the KVL and KCL in Electrical circuits
 - Explain the constructional features of AC and DC machines.
 - Identify electronics components and use of them to design circuits.
 - Use appropriate logic gates in circuit design.
 - Construct block diagram and explain satellite and optical Fibre communication systems.

- TEXTBOOKS**
- T1: Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
T2: Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.
Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic T3: Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.
- REFERENCES**
- R1: Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
R2: Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 1994.
R3: Premkumar N, "Basics of Electrical Engineering", Anuradha Publishers, 2003.
R4: T.Thyagarajan. "Fundamentals of Electrical and Electronics Engineering" Scitech Publications Pvt Ltd, 2011.

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PROGRAMME	Course Code	Name of the Course	L	T	P	C
B.E.	16GE2101	ENGINEERING MECHANICS (COMMON TO ALL BRANCHES)	3	1	0	4

The main objectives of the course are to:

Course Objective

1. Understand the vector and scalar representation of forces and moments
2. Understand the static equilibrium of particles and rigid bodies both in two dimensions.
3. Understand the principle of work and energy.
4. Comprehend the effect of friction on equilibrium.
5. Write the dynamic equilibrium equation.

UNIT	DESCRIPTION	TOTAL HOURS
	BASICS & STATICS OF PARTICLES	
I	Introduction – Units and Dimensions – Laws of Mechanics – Lamé’s theorem, Parallelogram and triangular Law of forces – Vectors – Vector representation of forces and moments – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.	12
	EQUILIBRIUM OF RIGID BODIES	
II	Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis– Scalar components of a moment – Varignon’s theorem – Single equivalent force – Equilibrium of Rigid bodies in two dimensions.	12
	PROPERTIES OF SURFACES AND SOLIDS	
III	Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – Second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas.	12
	DYNAMICS OF PARTICLES	
IV	Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton’s law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies. Co-efficient of restitution.	12
	FRICTION	
V	Frictional force – Laws of Coloumb friction – Simple contact friction – Rolling resistance – Wedge friction - Belt friction, Applications of friction.	12
	TOTAL INSTRUCTIONAL HOURS	60

Course Outcome

The outcomes of the course are the students shall have the ability:

- CO1: To solve engineering problems dealing with force, displacement, velocity and acceleration.
 CO2: To analyze the forces in any structure.
 CO3: To solve rigid body subjected to dynamic forces.

TEXT BOOKS:

1. F.P.Beer, and Jr. E.R.Johnston., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).

REFERENCE BOOKS:

1. R.C.Hibbeler, and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education 2010.
2. S.Rajasekaran and G.Sankarasubramanian, “Engineering Mechanics Statics and Dynamics”, 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
3. S.S.Bhavikatti, and K.G.Rajashekarappa, “Engineering Mechanics”, New Age International (P) Limited Publishers, 1998.

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Programme B.E.	Course Code 16HE2102R	Name of the Course ESSENTIAL ENGLISH FOR ENGINEERS – II (COMMON TO ALL BRANCHES)	L 3	T 1	P 0	C 4
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- Course Objective**
1. The learner will be introduced to global corporate culture and professional communication.
 2. It helps the students to focus on organizing professional event and documentation.
 3. The student will be able to describe the events and process in an effective way.
 4. It trains the student to analyze the problems and to find solution to it.
 5. The learner will be familiar with business communication.

Unit	Description	Instructional Hours
I	Introduction- talking about teamwork- Making arrangements- Improving Communication in spoken language – Taking and leaving Voice mail messages (present Tense, Past Tense and Present Perfect) Talking about Business Hotel- (Speaking Activity) Talking about Corporate Hospitality- Formal and Informal Language – Making accepting and declining invitations (Auxiliary Verb, Countable or Uncountable Nouns) – Focus on Language – Definitions and Extended Definitions- Reading comprehension.	12
II	Talking about orders – Clarity Written Language – Phone and Letter Phrases – Talking about Company Finances – Conditional 1 and 2 – Managing Cash Flow (Intention and Arrangements Conditional 1 and 2) – Talking about Brands and Marketing – Ethical Banking- Talking about Public Relations – Organizing a PR Event – Describing Duties and Responsibilities – (Future Tense and Articles) – Reported Speech – Modal Verbs and Passive, Impersonal Passive Voice- interpretation of posters or advertisements.	12
III	Talking about relocation – Report Phrases – Talking about Similarity and difference- Giving Directions- Asking for Information and Making Suggestions – Talking about Location (Comparatives and Superlatives, Participles) – Talking about Company Performances- Describing Trends – Describing Cause and Effect – Talking about Environmental Impact – Discussing Green Issues – Language of Presentations (Adjectives and Adverbs, Determiners)- Homophones – Homonyms- Acronyms-Abbreviations- British and American words.	12
IV	Talking about Health and Safety – Expressing Obligation- Discussing Regulations- Talking about personnel Problems – Passives – Talking about Problem at Work (modal Verbs, Passives)-Talking about Expenses Claims- Talking about Air Travel (Relative Pronoun, Indirect Questions) – E-mail Writing - Note completion- Transcoding.	12
V	Talking about staff Benefits- Talking about Appraisal Systems (gerunds and Infinitives, Reported Speech) – Talking about Marketing Disasters – Expressing hypothetical Situations- Talking about entering Foreign Market (Conditional 3, Grammar review) – Letter for calling quotations, Replying for quotations – Placing an order and Complaint and reply to a complaint.	12
Total Instructional Hours		60

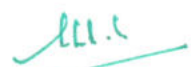
- Course Outcome**
- CO1: Introduced corporate culture and professional communication.
CO2: It focused on organizing a professional event and its documentation.
CO3: Improved the ability to describe the events and process in an effective way
CO4: Trained to analyze the problems and to find solution to it.
CO5: Practiced to make business communication.

TEXT BOOKS:

- T1 - Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition, 2014.
T2 - Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

REFERENCE BOOKS :

- R1 - Communication Skills for Engineers, Sunitha Misra & C.Murali Krishna, Pearson Publishers
R2 - Technical Communication, Daniel G. Riordan, Cengage learning publishers.
R3 - Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan,2010.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CY2103	CHEMISTRY FOR CIVIL ENGINEERING (B.E. CIVIL ENGINEERING)	3	0	0	3

- Course Objective**
1. To be conversant with the principles of electrochemistry, corrosion of materials and corrosion prevention.
 2. To acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
 3. To gain knowledge on industrial importance of Phase rule and alloys
 4. To acquire knowledge on the preparation, properties and applications of engineering materials.
 5. To be conversant with the types of fuels, calorific value calculations, manufacture of various types of fuels.

Unit	Description	Instructional Hours
	ELECTROCHEMISTRY AND CORROSION	
I	Electrochemical cells - reversible and irreversible cells – EMF – measurement of EMF – Single electrode potential – Nernst equation (problem) – electrochemical series – significance. Corrosion- causes- types - Chemical corrosion: oxidation corrosion – Pilling-Bedworth rule; electrochemical corrosion: mechanism – hydrogen evolution mechanism – oxygen absorption mechanism – galvanic corrosion – differential aeration corrosion; factors influencing corrosion; corrosion control: cathodic protection: sacrificial anodic protection – impressed current cathodic protection electroplating: electroplating of gold; electroless plating: advantages over electroplating – electroless plating of nickel.	9
	CHEMICAL THERMODYNAMICS	
II	Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs Helmholtz equation- Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore.	9
	PHASE RULE AND ALLOYS	
III	Phase rule: Introduction, definition of terms with examples, One Component System- water system- Reduced phase rule - Two Component Systems- classification – lead-silver system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.	9
	ENGINEERING MATERIALS	
IV	Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement-properties and uses.	9
	FUELS AND COMBUSTION	
V	Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel.	9
Total Instructional Hours		45

Course Outcome

- CO1: Illustration of the type of corrosion, its mechanism and corrosion control methodologies.
 CO2: Knowledge on second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
 CO3: Summarize the classification, preparation, properties and application of ferrous and non ferrous alloys.
 CO4: Understand the manufacture, properties and uses of various engineering materials.
 CO5: Classify the various types of fuel and their analysis and other techniques.

TEXT BOOKS:

- T1 - P.C.Jain & Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub. Co., New Delhi (2015).
 T2 - O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCE BOOKS:

- R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
 R2 - B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2005).
 R3 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2010).

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Programme B.E.	Course Code 16PH2102	Name of the Course PHYSICS OF MATERIALS (COMMON TO ALL BRANCHES)	L 3	T 0	P 0	C 3
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- Course Objective**
1. Gain knowledge about conducting materials.
 2. Provide fundamental knowledge of semiconducting materials which is related to the engineering program.
 3. Extend the properties of magnetic materials, applications and super conducting materials.
 4. Defend the various types of dielectric materials and their uses.
 5. Expose the students to smart materials and the basis of nano technology.

Unit	Description	Instructional Hours
	CONDUCTING MATERIALS	
I	Introduction – Conductors – Classical free electron theory of metals – Electrical and thermal conductivities – Wiedemann–Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.	9
	SEMICONDUCTING MATERIALS	
II	Introduction – Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors – direct and indirect band gap of semiconductors- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – Applications	9
	MAGNETIC & SUPERCONDUCTING MATERIALS	
III	Magnetic Materials: Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications. Superconducting Materials : Superconductivity : properties (Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.	9
	DIELECTRIC & COMPOSITES MATERIALS	
IV	Introduction – Electrical susceptibility – dielectric constant – polarization - electronic, ionic, orientation and space charge polarization – internal field – Clausius – Mosotti relation (derivation) – dielectric loss and dielectric breakdown (qualitative) Introduction to composites materials – types of composites materials – polymer, metallic and ceramic matrix composites (qualitative). Application in surgery, sports equipment.	9
	SMART MATERIALS AND NANOTECHNOLOGY	
V	New Engineering Materials: Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications. Nano Materials: Synthesis - plasma arcing – Chemical vapour deposition – properties of nanoparticles and applications. – Carbon nano tubes – fabrication – pulsed laser deposition - Chemical vapour deposition - properties & applications.	9
	Total Instructional Hours	45

- Course Outcome**
- CO1: Illustrate the electrical / thermal conductivity of conducting materials.
CO2: Understand the purpose of the acceptor or donor levels and the band gap of a semiconductor.
CO3: Interpret the basic idea behind the process of magnetism and applications of magnetic materials in every day life
CO4: Identify and compare the various types of dielectric polarization and dielectric breakdown.
CO5: Evaluate the properties and applications of various advanced engineering materials and develop the new ideas to synthesis Nanomaterials

TEXT BOOKS:

- T1 - S.O.Pillai "Solid State Physics" New Age International Publishers, New Delhi – 2011
T2- Rajendran V "Materials Science" McGraw-Hill Education" New Delhi -2016.

REFERENCE BOOKS:

- R1 - William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2014.
R2 - Raghavan, V. "Materials Science and Engineering – A First Course" Prentice Hall of India, New Delhi 2016.
R3 -Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2013

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA2102	ENGINEERING MATHEMATICS-II (COMMON TO ALL BRANCHES)	3	1	0	4
Course Objective	1. Learn the basics of vector calculus comprising gradient, divergence, Curl and line, surface, volume integrals. 2. Understand analytic functions of complex variables and conformal mappings. 3. Know the basics of residues, complex integration and contour integration. 4. Apply Laplace transform techniques to solve linear differential equations. 5. Know the effective mathematical tools for the solutions of partial differential equations that model several physical problems in mathematical physics					
Unit	Description	Instructional Hours				
I	VECTOR CALCULUS Gradient, divergence and curl–Directional derivative–Irrotational and solenoidal vector fields– Vector integration –Green’s theorem in the plane, Gauss divergence theorem and Stokes’ theorem (excluding proofs)–Simple applications involving cubes and rectangular parallel pipeds.	12				
II	ANALYTIC FUNCTIONS Analytic function -Cauchy-Riemann equations -sufficient conditions (excluding proof) – Harmonic - conjugate harmonic functions– Construction of analytic functions (Milne-Thompson method)– Conformal mapping: $w = z + c, cz, 1/z$ and bilinear transformation without problems related to the concept of conformal mapping.	12				
III	COMPLEX INTEGRATION Complex integration–Statements of Cauchy’s integral theorem– Taylor’s and Laurent’s series expansions - Singular points–Residues–Cauchy’s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle.	12				
IV	LAPLACE TRANSFORM Laplace transform–Basic properties –Transforms of derivatives and integrals of functions– Transform of unit step function and impulse function– Transform of periodic functions. Inverse Laplace transform–Convolution theorem (without proof) – Solution of linear ODE of second order with constant coefficient using Laplace transformation techniques.	12				
V	PARTIAL DIFFERENTIAL EQUATIONS Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions– Solution of standard types of first order partial differential equations of the form $f(p, q) = 0$, Clairaut’s type: $z = px + qy + f(p, q)$ – Lagrange’s linear equation- Linear homogeneous partial differential equations of second and higher order with constant coefficient.	12				
		Total Instructional Hours	60			
Course Outcome	CO1: Know the gradient, divergence and curl of vectors useful for engineering application like fluidflow, electricity and magnetism. CO2: Test the analyticity to construct the analytic function and transform complex functions from one plane to another plane graphically. CO3: Evaluate real and complex integrals over suitable closed paths or contours. CO4: Know the applications of Laplace transform and its properties and to solve certain linear differential equations using Laplace transform technique. CO5: Solve the engineering problems using Partial Differential Equations.					

TEXT BOOKS:

- T1 - Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd., Chennai, 2017.
 T2 - Veerarajan T, "Engineering Mathematics-II", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016

REFERENCE BOOKS :

- R1 - Bali N.P & Manish Goyal, "A Textbook of Engineering Mathematics", 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
 R2 - Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
 R3 - Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
 R4 - Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol II, Second Edition, Pearson publishing, 2011.
 R5 - Wylie & Barrett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1003	VALUE ADDED COURSE I: LANGUAGE COMPETENCY ENHANCEMENT COURSE-I (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective	✓ To enhance student language competency
	✓ To identify individual students level of communication skills
	✓ To develop English Vocabulary and spoken communication skills.
	✓ To revive the fundamentals of English Grammar.

Unit	Description	Instructional Hours
I	Listening Language of Communication- English listening- Hearing Vs Listening- Verbal and Non-verbal communication – Listening strategies-Sounds of English.	3
III	Reading English Language Enhancement – Indianism in English – Role of Reading in effective communication – Techniques for good reading (skimming and scanning) Reading articles from newspaper, magazine. Reading and interpreting a passage.	3
III	Speaking Common errors in Pronunciation – Signposts in English (Role play) – Public Speaking skills – Social Phobia – Eliminating fear – Common etiquette of speaking - Debate and Discuss.	3
IV	Writing Writing genre – Enhancement of basic English Vocabulary; Parts of Speech, Noun, Verbs, and Tenses – combining sentences, sentence formation and completion.	3
V	Art of Communication Communication process – Word building and roleplay – Exercise on English Language for various situations through online and offline activities.	3
Total Instructional Hours		15

Course Outcome	CO1- Trained to maintain coherence and communicate effectively.
	CO2- Practiced to create and interpret descriptive communication.
	CO3- Introduced to gain information of the professional world.
	CO4- acquired various types of communication and etiquette.
	CO5- Taught to improve interpersonal and intrapersonal skills.

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma, 9th edition, Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis, – Print, 1 June 2011.
3. High School English Grammar by Wren and Martin, S.CHAND Publications, 1 January 2017
Practical course in Spoken English by J.K. Gangal, PHI Learning , Second edition, 1 January 2018.


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GROUP B (ELECTRICAL & ELECTRONICS)

S.No	Description of the Experiments
ELECTRICAL ENGINEERING PRACTICES	
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring
3	Stair case wiring.
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5	Measurement of energy using single phase energy meter.

ELECTRONICS ENGINEERING PRACTICES

1	Study of Electronic components and equipments – Resistors - colour coding
2	Measurement of DC signal - AC signal parameters (peak-peak, RMS period, frequency) using CRO.
3	Study of logic gates AND, OR, NOT and NAND .
4	Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5	Measurement of average and RMS value of Half wave and Full Wave rectifiers.

Total Practical Hours

45

**Coure
Outcome**

CO1: Fabricate wooden components and pipe connections including plumbing works.CO2: Fabricate simple weld joints.
CO3: Fabricate electrical and electronics circuits.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1002	ENGINEERING PRACTICES LAB (COMMON TO ALL BRANCHES)	0	0	4	2

Course Objective To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

Expt. No. **Description of the Experiments**

I CIVIL ENGINEERING PRACTICE

Study of plumbing and carpentry components of Residential and Industrial buildings.

(A) PLUMBING WORKS:

- 1 Study on pipe joints, its location and functions: Valves, taps, couplings, unions, reducers, elbows in household fittings.
- 2 Study of pipe connection requirements for pumps.
- 3 Preparation of plumbing line sketches for water supply and sewage works.
- 4 Hands-on-exercise:
 - Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- 5 Demonstration of plumbing requirements of high-rise buildings.

(B) CARPENTRY USING POWER TOOLS ONLY:

- 1 Study of the joints in roofs, doors, windows and furniture.
- 2 Hands-on-exercise in wood works by sawing, planning and cutting.

II MECHANICAL ENGINEERING

(A) Welding:

- 1 Preparation of arc welding of Butt joints, Lap joints and Tee joints

(B) Machining:

- 1 Practice on Simple step turning and taper turning
- 2 Practice on Drilling Practice

(C) Sheet Metal Work:

- 1 Practice on Models– Trays, cone and cylinder.

DEMONSTRATION

(D) Smithy

- Smithy operations: Upsetting, swaging, setting down and bending.
- Demonstration of – Production of hexagonal headed bolt.

(E) Gas welding

(F) Foundry Tools and operations.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16GE1001	COMPUTER PROGRAMMING LAB (COMMON TO ALL BRANCHES)	0	0	4	2

- Course Objective**
1. Be familiar with Microsoft office software.
 2. Be exposed to role of constants, variables, identifiers, operators and other building blocks of C Language.
 3. Be familiar with the use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.
 4. Be familiar with the concept of Array and pointers dealing with memory management.
 5. Be exposed to Structures and unions.

S.NO	DESCRIPTION PF THE EXPERIMENTS	TOTAL PRACTICAL HOURS
	a. Word Processing:	
1.	1. Document creation, Text manipulation with Scientific notations 2. Table creation, Table formatting and conversion 3. Mail merge and Letter preparation 4. Flow Chart	3
	b. Spread Sheet:	
2.	1. Chart - Line, XY, Bar and Pie. 2. Formula - formula editor. 3. Spread sheet - inclusion of object, picture and graphics, protecting the document and sheet. 4. Sorting and Import / Export features.	6
	c. Basic C programming:	
3.	C program using I/O Statements	3
4.	C program using arithmetic operations	3
	Decision making statement & Looping Concepts	
5.	<ul style="list-style-type: none"> • Designing a simple arithmetic calculator. (Use switch statement) • Performing the following operations: (Use loop statement) • Generate Pascal's triangle. • Construct a Pyramid of numbers. 	6
	d. Arrays and Strings	
6.	C program using one dimensional arrays	3
7.	C program using two dimensional arrays	3
8.	C program using string functions	3
	e. Functions and pointers	
	Perform the following operations: (Use recursive functions)	
9.	<ol style="list-style-type: none"> i. Find the factorial of a given integer. ii. Find the GCD (Greatest Common Divisor) of two given integers. iii. Solve Towers of Hanoi problem. 	6
10.	Program to swap two numbers using pointers - call by reference.	3
	f. Structures and Unions	
11.	C Program using Structures	3
12.	C Program using Unions	3
TOTAL INSTRCTIONAL HOURS		45

- Course Outcome**
- CO1: Use office packages for documentation and presentation.
CO2: Implement program using control structures.
CO3: Handle arrays and strings.
CO4: Handle functions and pointers.
CO5: Form heterogeneous data using structure and union.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS1001	PHYSICAL SCIENCES LAB - I CHEMISTRY LAB - I (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

1. Acquire practical skills in the determination of water quality parameters.
2. Acquaint the students with the determination of molecular weight of a polymer by viscometry.
3. Acquaint the students with the estimation of chemical substances using instrumental analysis techniques.

Expt. No.	Description of the Experiments
1.	Preparation of molar and normal solutions and their standardization.
2.	Estimation of total, permanent and temporary hardness of Water by EDTA
3.	Determination of chloride content of water sample by argentometric method.
4.	Determination of available chlorine in bleaching powder.
5.	Conductometric titration of strong acid vs strong base (HClvsNaOH).
6.	Conductometric titration (Mixture of weak and strong acids)
7.	Conductometric precipitation titration using BaCl ₂ and Na ₂ SO ₄
8.	Determination of molecular weight and degree of polymerization using viscometry.
9.	Estimation of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).

Total Practical Hours

30

Course Outcome:

- CO1: Estimate the different types of hardness in a water sample.
- CO2: Determine the chloride content of water sample.
- CO3: Calculate the strength of acid using conductometric titrations.
- CO4: Calculate the strength of strong and weak acid using conductometric titrations.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS1001	PHYSICAL SCIENCES LAB – I PHYSICS LAB I (COMMON TO ALL BRANCHES)	0	0	2	1

- Course Objective**
1. Evaluate the particle size of micro particles and acceptance angle of fibres.
 2. Employ instrumental method to determine Young's modulus of a beam of metals.
 3. Apply the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum.

Expt. No. Description of the Experiments

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle and numerical aperture in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method
6. Determination of Young's modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
8. Post office box Measurement of an unknown resistance

Total Practical Hours

30

- Course Outcome**
- CO:1 Point out the particle size of micro particles and acceptance angle of fibres using diode laser.
CO:2 Assess the Young's modulus of a beam using non uniform bending methods.
CO:3 Illustrate the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum Using spectrometer.
CO:4 Identify the velocity of ultrasonic's in the given liquid.
CO:5 Illustrate phenomena of thermal conductivity of a bad conductor.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1102	ENGINEERING GRAPHICS (COMMON TO ALL BRANCHES)	2	0	4	4

Course Objective

1. To provide drafting skills for communicating the Engineering concepts and ideas.
2. To expose to BIS and International standards related to engineering drawings.

Unit	Description	Total Hours
	PLANE CURVES	
I	Importance of engineering drawing, drafting instruments, drawing sheets – layout and folding, Lettering and dimensioning, BIS standards and scales. Geometrical constructions, Construction of ellipse, parabola and Hyperbola by eccentricity method, construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	15
	PROJECTIONS OF POINTS, LINES AND PLANE SURFACES	
II	Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	15
	PROJECTIONS OF SOLIDS	
III	Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane and objects inclined to both the planes by rotating object method.	15
	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	
IV	Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids. Intersection of solids-cylinder vs cylinder.	15
	ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	
V	Isometric views and projections of simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Perspective projection of solids in simple position using visual ray method.	15
Total Instructional Hours		75

Course Outcome

CO1: Draw the orthographic and isometric views of regular solid objects including sectional views.
CO2: Recognize the International Standards in Engineering Drawing practices.

TEXT BOOKS:

- T1 - K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th Edition New Age International Publishers, New delhi 2016.
T2 - K.V.Natarajan, "A textbook of Engineering Graphics", Dhanalaksmi Publishers, Chennai.

REFERENCE BOOKS:

- R1 - BasantAgrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi 2008.
R2 - K. R. Gopalakrishnan, "Engineering Drawing" (Vol. I & II), Subhas Publications, Bangalore, 1998.
R3 - M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson Education, India, 2005.
R4 - N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University press, India 2015.


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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
B.E.	16GE1101	COMPUTER PROGRAMMING (COMMON TO ALL BRANCHES)	3	0	0	3

- Course Objective**
1. Learn the fundamentals of computers.
 2. Learn the basics of C programming
 3. Learn the basics of Arrays and String
 4. Learn the uses of functions and pointers.
 5. Learn the basics of structures and unions.

UNIT	DESCRIPTION	TOTAL INSTRUCTIONAL HOURS
	BASICS OF COMPUTER Generation and Classification of Computers- Basic Organization of a Computer –Input and Output Devices–Hardware and Software definitions- Categories of Software- Number System Conversion and problems. Need for logical analysis and thinking – Algorithm -Pseudo code – Flow Chart.	9
I		
	BASICS OF 'C' PROGRAMMING Fundamentals of 'C' programming – Structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types –Expressions using operators in 'C' – Managing Input and Output operations-Decision making-Branching and Looping-Case study	9
II		
	ARRAYS AND STRINGS Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String Library functions – String Arrays. Matrix operations-Addition-Subtraction-Multiplication-Transpose-Case study.	9
III		
	FUNCTIONS AND POINTERS Function – definition – Declaration – Types of Function definition – call by value-call by reference- Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays-Case study.	9
IV		
	STRUCTURES AND UNIONS Structure- data type – definition – declaration –Nesting of structure - Union – Storage classes, Pre-processor directives-Case study.	9
V		
TOTAL INSTRUCTIONAL HOURS		45

- Course Outcome**
- CO1:Use computers at user level, including operating systems, programming environments and differentiate between basic concepts of computer hardware and software.
- CO2: Analyze problems, design and implementing algorithmic solutions.
- CO3:Use data representation for the fundamental data types, read, understand and trace the execution of programs written in C language.
- CO4: Write the C code using a modular approach and recursive concepts.
- CO5: Explain the use of pointers, Structures and union.

TEXT BOOKS:

- T1 – Balagurusamy "Programming in ANSI C", Seventh Edition, McGraw-Hill, 2016.
- T2 - Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.

REFERENCE BOOKS:

- R1 - Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.
- R2- M.Rajaram and P.Uma maheswari, "Computer Programming with C" Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2014.
- R3 - Dr.N.Sengottaiyan and K.Ramya, "Fundamentals of Computer Programming",Cengage Learning (India) Pvt. Ltd.,2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA1101	ENGINEERING MATHEMATICS - I (COMMON TO ALL BRANCHES)	3	1	0	4
Course Objective	1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications. 2. Find curvature, evolutes and envelopes using the concept of differentiation. 3. Solve ordinary differential equations of certain types using Wronskian technique. 4. Familiarize the functions of several variables which are needed in many branches of engineering. 5. Understand the concept of double and triple integrals.					
Unit	Description		Instructional Hours			
	MATRICES					
I	Eigen values and Eigen vectors of area matrix– Properties of Eigen values and Eigen vectors (without proof)–Cayley-Hamilton Theorem (excluding proof)– Orthogonal matrices– 12 Diagonalization of matrices by orthogonal transformation–Reduction of a quadratic form to canonical form by orthogonal transformation.					
	DIFFERENTIAL CALCULUS					
II	Curvature in Cartesian co-ordinates – Radius and Centre of curvature - Circle of curvature – 12 Involutes and Evolutes (parabola, ellipse, cycloid, asteroid) – Envelopes - single parameter and two parameter family of curves.					
	ORDINARY DIFFERENTIAL EQUATIONS					
III	Second and higher order linear differential equations with constant coefficients and with RHS of the 12 form e^{ax} , x^n , $\sin x$ or $\cos x$, $e^{ax}f(x)$ and $xf(x)$ where $f(x)$ is $\sin x$ or $\cos x$ – Method of variation of parameters – Linear differential equations with variable coefficients (Euler’s equation)					
	FUNCTIONS OF SEVERAL VARIABLES					
IV	Total differentiation (excluding implicit functions) - Partial derivatives of composite functions -12 Taylor’s series for functions of two variables- Maxima and minima of functions variables - Lagrange’s method of undetermined multipliers – Jacobians.					
	MULTIPLE INTEGRALS					
V	Double integrals in Cartesian coordinates–Change of order of integration–Area enclosed by the plane 12 curves (excluding surface area)– Triple integrals in Cartesian co-ordinates – Volume of solids using Cartesian co-ordinates.					
	Total Instructional Hours 60					
Course Outcome	CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibrational modes CO2: Apply the concept of differentiation to find the radius, centre and circle of curvature of any curve CO3: Develop sound knowledge of techniques in solving ordinary differential equations that model engineering problems CO4: Identify the maximum and minimum values of surfaces. CO5: Computation of area of a region in simpler way by changing the order of integration and evaluation of triple integrals to compute volume of three dimensional solid structures.					
	TEXT BOOKS:					
	T1- Ravish R Singh, Mukul Bhatt, “Engineering Mathematics”, McGraw Hill education (India) Private Ltd., Chennai, 2017.					
	T2- Veerarajan T, “Engineering Mathematics–I”, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016					
	REFERENCE BOOKS :					
	R1-Bali N.P & Manish Goyal, “A Textbook of Engineering Mathematics”, 8 th Edition, Laxmi Pub. Pvt. Ltd. 2011.					
	R2- Grewal B.S, “Higher Engineering Mathematics”, 42 nd Edition, Khanna Publications, Delhi, 2012.					
	R3- Peter V. O’Neil, “Advanced Engineering Mathematics”, 7 th Edition, Cengage learning, 2012.					
	R4-Sivarama Krishna Das P and Rukmangadachari E., “Engineering Mathematics” Vol I, Second Edition, Pearson publishing, 2011.					
	R5- Wylie & Barrett, “Advanced Engineering Mathematics”, McGraw Hill Education, 6 th edition, 2009					

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PH1101	ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	3	0	0	3

Course Objective

1. Illustrate the fundamental knowledge in mechanical properties of matter and thermal physics.
2. Gain knowledge about laser and their applications.
3. Conversant with principles of optical fiber, types and applications of optical fiber.
4. Discuss the architectural acoustics and applications of Ultrasonics.
5. Extend dual nature of matter and the Necessity of quantum mechanics to explore the behavior of sub atomic particles.

Unit	Description	Instructional Hours
PROPERTIES OF MATTER AND THERMAL PHYSICS		
I	Elasticity – Hooke's law – Stress-strain diagram - Relation between three moduli of elasticity (qualitative) — Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending – I-shaped girder. Modes of heat transfer – Thermal conductivity – Newton's law of cooling - Lee's disc method - Conduction through compound media (series and parallel).	9
LASER AND APPLICATIONS		
II	Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Types of lasers – Nd:YAG laser, CO2 laser, Semiconductor lasers:(homojunction and heterojunction) – Laser Applications – Industrial applications: laser welding, laser cutting, laser drilling – Holography – Construction and reconstruction of images.	9
FIBER OPTICS AND APPLICATIONS		
III	Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Crucible-crucible technique for fiber fabrication – Sources (LED and LASER) and detectors (p-i-n photodiode and avalanche photodiode) for fiber optics - Fiber optical communication link –Fiber optic sensors – Temperature and displacement sensors.	9
ACOUSTICS AND ULTRASONICS		
IV	Classification of sound – Weber–Fechner law – Sabine's formula (no derivation) - Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies. Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Non destructive testing – Ultrasonic pulse echo system.	9
QUANTUM PHYSICS AND APPLICATIONS		
V	Black body radiation – Planck's theory (derivation) –Compton effect experimental verification only - Matter waves – Physical significance of wave function – Schroedinger's wave equations – Time independent and time dependent wave equations –Particle in a box (One dimensional) – Scanning electron microscope – Transmission electron microscope.	9

Total Instructional Hours 45

Course Outcome

CO1: Enhance the fundamental knowledge in Properties of Matter and Thermal Physics.
CO2: Understand the advanced technology of LASER in the field of Engineering and medicine.
CO3: Exposed the fundamental knowledge of Optical fiber in the field of communication Engineering.
CO4: Understand the production of ultrasonics and its applications in NDT.
CO5: Impart the fundamental knowledge on Quantum Physics.

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2010
R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company Ltd., New Delhi, 2014


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CY1101	ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	3	0	0	3

- Course Objective**
1. The student should be conversant with boiler feed water requirements, related problems and water treatment techniques.
 2. The student should be conversant with the principles of polymer chemistry and engineering applications of polymers and composites
 3. The student should be conversant with the principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
 4. To acquaint the student with important concepts of spectroscopy and its applications.
 5. To acquaint the students with the basics of nano materials, their properties and applications

Unit	Description	Instructional Hours
I WATER TECHNOLOGY	Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, calculations, estimation of hardness of water – EDTA method - scales and sludges – boiler corrosion – priming and foaming – caustic embrittlement; Conditioning methods of hard water – External conditioning - demineralization process- Internal conditioning - domestic water treatment: screening, sedimentation, coagulation, filtration, disinfection – chlorine – UV method; desalination: definition, reverse osmosis.	9
II POLYMER & COMPOSITES	Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Teflon – moulding of plastics (extrusion and compression); rubber: vulcanization of rubber, synthetic rubber – butyl rubber, SBR; composites: definition, types of composites – polymer matrix composites – FRP.	9
III ENERGY SOURCES AND STORAGE DEVICES	Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H ₂ -O ₂ fuel cell applications.	9
IV ANALYTICAL TECHNIQUES	Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – interferences - estimation of nickel by atomic absorption spectroscopy.	9
V NANOMATERIALS	Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: definition, carbon nanotubes (CNT), types of carbon nano tubes – single walled and multi walled carbon nanotubes – synthesis of carbon nanotubes: chemical vapour deposition – laser ablation – arc-discharge method; properties of CNT: mechanical, electrical, thermal and optical properties; applications of carbon nanotubes in chemical field, medicinal field, mechanical field and current applications.	9

Total Instructional Hours 45

- Course Outcome**
- CO1: Illustration of the basic parameters of water, different water softening processes and effect of hard water in industries.
- CO2: Knowledge on basic properties and application of various polymers and composites as an engineering material.
- CO3: Summarize the various energy sources and energy storage devices
- CO4: Analyze various analytical skills in handling various machines, instruments, apart from understanding the mechanism involved.
- CO5: Describe the basic properties and application of nanomaterials.

TEXT BOOKS

- T1 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2015).
T2 - O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCES

- R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008). R2 - B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2005). R3 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand&Co.Ltd., New Delhi (2010).

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16HE1101R	ESSENTIAL ENGLISH FOR ENGINEERS - I (COMMON TO ALL BRANCHES)	3	1	0	4

- Course Objective**
1. It fulfills the necessary skills needed in today's global workplaces.
 2. Student will be able to interpret and illustrate formal communication.
 3. It empowers students in choosing right lexical techniques for effective presentation
 4. It equips the learner to analyze and list out things in logical order
 5. The learner develops the ability to create and integrate ideas in a professional way.

Unit	Description	Instructional Hours
I	Getting to know people – Introduction – Talking about jobs (Present Simple) – Talking about working conditions(Adverb of Frequency) - Talking about company history and structure (Past simple, Prepositions of Time) – Talking about company activities (Connectors of addition and contrast, Present Continuous) – Focus on language – Parts of Speech – Gerund and Infinitives – Instruction- General Vocabulary.	12
II	Vocabulary practice – (Telephoning Leaving and taking messages) – requests and obligation – Describing trends (Adjectives and Adverbs) – Talking about company performance (present perfect and past simple, Reasons and consequences) – Reading Test Practice Describing products Dimensions, (Comparatives and Superlatives, Question formation) – Talking about product development (Sequencing words, Present continuous and going to) – Articles – Prepositions- Synonyms – Antonyms- Recommendations- Interpretation of a chart.	12
III	Talking about business equipment (Giving Instruction) – Letter Phrases- Writing Test Practice- Talking about facilities(Asking for and giving direction)- Presentation on a general topic -Talking about traffic and transport(making predictions)- Discussion on current affairs – Tenses- Present – Past-Future-Forms of verbs- Word techniques- Formation-Prefixes-Suffixes.	12
IV	Talking about conference arrangement(checking and confirming) – Talking about a conferencebefore, after, when, until etc. – Listening Test Practice- talking about production process – passive- Talking about quality control Conditional 1 (real) (Making suggestions) – Itinery- Jumbled sentences- Paragraph writing- Essay writing – Checklist- Letter to Inviting Dignitaries – Accepting invitation- Declining Invitation.	12
V	Talking about call centers, insurance and changes in working practices (future possibility/probability)- Talking about banking- Speaking Test practice – Talking about delivery services (preposition of Time)- Talking about trading (Tense review)- Talking about recruitment conditional 2 (hypothetical) – talking about job applications (indirect questions) – Reading, Writing and Listening Test – Job application Letter and Resume Writing- Permission letters.	12
Total Instructional Hours		60

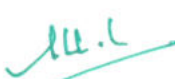
- Course Outcome**
- CO1 - Recognize different parts of speech for better usage.
 - CO2 - Interpret and illustrate formal communication
 - CO3 - Choosing right lexical techniques for effective presentation.
 - CO4 - Analyze and list out things in logical order.
 - CO5 - Create and integrate ideas in a professional way.

TEXT BOOKS:

- T1 – Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.
- T2 - Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

REFERENCE BOOKS:

- R1 - Meenakshi Raman and Sangeetha Sharma. "Technical Communication-Principles and Practice", Oxford University Press, 2009.
- R2 - Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi, 2005
- R3 - Kamallesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.


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HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution
Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited with 'A' Grade by NAAC, Accredited by NBA (ECE, MECIL, EEE, IT & CSE)
Coimbatore - 641 032



DEPARTMENT OF CIVIL ENGINEERING
For the students studying in the academic year 2017 – 2018

16MA1101 – ENGINEERING MATHEMATICS -I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Average	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

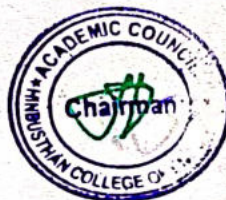
16PH1101 – ENGINEERING PHYSICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	1	1	2	2	1
CO2	3	3	1	1	2	1	1	1	1	1	1	2	2	1
CO3	3	2	1	2	2	1	1	1	1	1	1	2	2	1
CO4	3	2	3	2	3	1	1	1	1	1	1	2	2	1
CO5	3	2	3	2	2	2	1	1	1	1	1	2	2	1
Average	3	2.2	2	1.6	2	1.2	1	1	1	1	1	2	2	1

16CY1101- ENGINEERING CHEMISTRY

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	2	1	1	1	1	1	1	1	1	1
CO2	3	2	2	1	2	1	1	1	1	1	1	1	1	1
CO3	3	2	2	1	2	1	1	1	1	1	1	1	1	1
CO4	3	2	2	2	2	1	1	1	1	1	1	1	1	1
CO5	3	2	2	1	2	1	1	1	1	1	1	1	1	1
Average	3	2	2	1.2	2	1	1	1	1	1	1	1	1	1

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16HE1101R- ESSENTIAL ENGLISH FOR ENGINEERS-I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Average	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

16GE1103 - PROBLEM SOLVING AND PYTHON PROGRAMMING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	1	1	1	1	1	2	2	3	3
CO2	3	3	2	1	1	1	1	1	1	1	1	2	2	3
CO3	3	3	2	1	1	1	1	1	1	1	1	2	2	3
CO4	3	3	1	1	1	1	1	1	1	1	1	2	2	3
CO5	3	1	1	1	1	1	1	1	1	1	1	1	2	1
Average	3	2.6	1.4	1	1	1	1	1	1	1	1	1.8	2.2	2.6

16GE1102- ENGINEERING GRAPHICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
Average	3	2	2.6	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6

16PS1001 - PHYSICAL SCIENCESLAB-I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
Average	3	2	2	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6

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16GE1004 – PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
Average	3	2	2.6	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6

16GE1002 – ENGINEERING PRACTICES LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
Average	3	2	2.6	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6

16MA2102 – ENGINEERING MATHEMATICS–II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	1	1	1	1	1	1	2	2	2
CO2	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO3	3	3	3	3	3	1	1	1	1	1	1	2	1	2
CO4	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO5	3	3	3	2	3	1	1	1	1	1	1	2	2	2
Average	3	3	3	2.6	2.8	1	1	1	1	1	1	2	1.8	1.6

16PH2102- PHYSICS OF MATERIALS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	1	1	2	2	1
CO2	3	3	1	1	2	1	1	1	1	1	1	2	2	1
CO3	3	2	1	2	2	1	1	1	1	1	1	2	2	1
CO4	3	2	3	2	3	1	1	1	1	1	1	2	2	1
CO5	3	2	3	2	2	2	1	1	1	1	1	2	2	1
Average	3	2.2	2	1.6	2	1.2	1	1	1	1	1	2	2	1

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16CY2103- CHEMISTRY FOR CIVILENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Average	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

16HE2102R – ESSENTIAL ENGLISH FOR ENGINEERS–II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	1	1	2	2	1
CO2	3	3	1	1	2	1	1	1	1	1	1	2	2	1
CO3	3	2	1	2	2	1	1	1	1	1	1	2	2	1
CO4	3	2	3	2	3	1	1	1	1	1	1	2	2	1
CO5	3	2	3	2	2	2	1	1	1	1	1	2	2	1
Average	3	2.2	2	1.6	2	1.2	1	1	1	1	1	2	2	1

16GE2101 – ENGINEERING MECHANICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	1	1	2	1	2	3	1	3	1	1
CO2	3	3	3	1	1	2	1	1	1	3	1	2	1	1
CO3	3	3	3	1	1	2	1	1	2	3	1	2	1	2
CO4	3	3	3	1	1	1	1	1	2	3	1	2	1	1
CO5	3	3	3	1	1	1	1	2	2	3	1	2	1	2
Average	3	3	3	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

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16EE2202 – BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Average	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

16PS2001 – PHYSICAL SCIENCES LAB-II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Average	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

16CE2001- COMPUTER AIDED DRAWING LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Average	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

16MA3104-FOURIER ANALYSIS AND NUMERICAL

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	-	2	2	2
CO2	3	2	3	2	1	-	-	-	-	-	-	2	2	2
CO3	2	3	2	2	1	-	-	-	1	-	-	1	2	2
CO4	2	2	2	2	1	-	-	-	-	-	-	2	2	2
CO5		2		2	1	-	-	-	-	-	-	1		2
Average	2.5	2.4	2.5	2.0	1.0	-	-	-	1.0	-	-	1.6	2.1	2.0

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16CE3201- MECHANICS OF SOLIDS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO2	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO3	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO4	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO5	3	3	3	2	1	-	-	-	-	-	1	3	3	3
Average	3.0	3.0	3.0	2.0	1.0	-	-	-	-	-	1.0	3.0	3.0	3.0

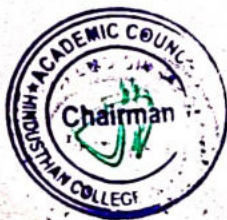
16CE3202-MECHANICS OF FLUIDS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	1	3	-	1	1	1	3	3	3
CO2	3	2	1	1	-	1	2	1	1	1	1	3	2	2
CO3	3	2	1	2	-	1	2	-	1	1	1	3	2	2
CO4	3	2	1	2	1	1	1	1	1	1	1	3	1	2
CO5	3	1	1	2	1	1	1	1	1	1	1	3	1	2
Average	3.0	2.0	1.2	1.6	1.0	1.0	1.8	1.0	1.0	1.0	1.0	3.0	1.8	2.2

16CE3203 - CONSTRUCTION MATERIALS, EQUIPMENT AND PRACTICES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	3	-	2	1	3	1	3	3	2
CO2	3	2	3	2	-	2	1	1	1	2	1	3	3	2
CO3	3	3	1	2	1	3	2	1	2	3	1	3	3	2
CO4	3	2	3	2	2	2	-	2	2	1	1	3	2	2
CO5	3	2	3	2	2	2	-	2		2	2	3	2	3
Average	3.0	2.0	2.4	2.0	1.7	2.4	1.5	1.6	1.5	2.2	1.2	3.0	2.6	2.2

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16CE3204 - SURVEYING-I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	1	1	1	2	1	1	1	3	2	1
CO2	3	2	1	2	1	1	1	1	1	1	1	2	1	1
CO3	3	2	1	2	1	1	1	1	1	1	1	3	2	2
CO4	3	2	1	2	1	1	1	1	1	1	1	3	2	2
CO5	2	2	1	2	1	1	1	2	1	1	1	3	2	1
Average	2.6	2.0	1.0	2.0	1.0	1.0	1.0	1.4	1.0	1.0	1.0	2.8	1.8	1.4

16CE3205 – ENVIRONMENTAL SCIENCE AND ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	2	3	-	-	-	1	1	1	2
CO2	2	2	1	-	-	2	2	-	-	-	1	1	2	2
CO3	2	2	1	-	1	2	2	-	-	-	1	1	2	2
CO4	2	2	1	-	-	3	2	-	-	-	1	2	1	2
CO5	1	1	1	-	1	2	2	-	-	-	1	2	1	2
Average	1.6	1.6	1.0	-	1.0	2.2	2.2	-	-	-	1.0	1.4	1.4	2.0

16CE3001 – SURVEY LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1	-	1	3	3	1	2	2	2
CO2	2	2	1	1	3	1	-	1	3	3	1	2	2	2
CO3	2	2	1	1	3	1	-	1	3	3	1	2	2	2
CO4	2	2	1	1	2	1	-	1	3	3	1	2	2	2
CO5	2	2	1	1		1	-	1	3	3	1	2	2	2
Average	2.0	2.0	1.0	1.0	2.5	1.0	-	1.0	3.0	3.0	1.0	2.0	2.0	2.0

M. J.
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16CE3002 – COMPUTER AIDED BUILDING DRAWING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	3	1	-	-	2	1	2	2	3	3
CO2	2	2	2	1	3	1	-	-	2	1	2	2	3	2
CO3	2	2	1	1	3	1	-	-	1	1	2	2	2	2
CO4	3	3	3	2	3	1	-	-	2	1	2	2	3	1
CO5	1	1	2	1	3	1	-	-	2	1	1	1	2	2
Average	2.0	2.0	2.0	1.2	3.0	1.0	-	-	1.8	1.0	1.8	1.8	2.6	2.0

16MA4110 - APPLIED PROBABILITY AND STATISTICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	2	2	1	2	2	2	1	2	2
CO2	2	2	2	3	2	2	2	1	2	2	2	1	2	2
CO3	3	3	3	1	3	3	3	1	3	3	3	1	3	3
CO4	1	1	1	2	1	1	1	1	1	1	1	1	1	1
CO5	2	2	2	2	2	2	2	1	2	2	2	1	2	2
Average	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	1.0	2.0	2.0

16CE4201 – STRENGTH OF MATERIALS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO2	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO3	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO4	3	3	3	2	1	-	-	-	-	-	1	3	3	3
CO5	3	3	3	2	1	-	-	-	-	-	1	3	3	3
Average	3.0	3.0	3.0	2.0	1.0	-	-	-	-	-	1.0	3.0	3.0	3.0

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16CE4202 – APPLIED HYDRAULICS AND HYDRAULIC MACHINERY

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	1	2	-	1	2	1	3	2	3
CO2	3	2	2	2	1	3	2	1	1	2	-	3	2	2
CO3	3	2	1	2	2	1	1	1	2	1	3	2	3	3
CO4	3	3	3	2	1	3	1	-	1	2	2	3	2	3
CO5	3	3	3	2	1	3	2	1	1	-	1	3	3	3
Average	3.0	2.4	2.0	2.0	1.3	2.2	1.6	1.0	1.2	1.8	1.8	2.8	2.4	2.8

16CE4203 – SOIL MECHANICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	1	-	2	2	1	1	3	3	3
CO2	3	3	3	1	2	1	-	1	1	1	-	3	3	3
CO3	3	2	3	2	1	2	-	1	2	1	-	3	3	3
CO4	3	3	3	3	2	3	1	3	1	2	3	3	3	3
CO5	3	3	3	2	1	1	-	2	1	1	-	3	3	3
Average	3.0	2.8	2.8	2.0	1.8	1.6	1.0	1.8	1.4	1.2	2.0	3.0	3.0	3.0

16CE4204 – SURVEYING II

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	2	1	1	1	1	1	1	1	1	1
CO2	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO3	2	1	-	1	3	1	2	1	1	1	1	1	1	1
CO4	2	1	1	1	2	1	-	-	1	-	-	1	1	1
CO5	2	1	1	1	2	1	2	1	1	1	1	1	1	1
Average	2.0	1.2	1.0	1.0	2.2	1.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0

16CE4205 – HIGHWAY AND RAILWAY ENGINEERING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	1	-	1	1	1	1	2	1	2
CO2	3	2	3	3	3	1	1	1	1	1	1	2	1	2
CO3	3	2	3	3	3	1	1	1	-	-	1	2	1	2
CO4	3	2	3	3	3	1	1	1	1	1	1	2	1	2
CO5	3	2	3	3	3	1	1	1	1	1	1	2	1	2
Average	3.0	2.0	2.8	2.8	3.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	2.0

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16CE4001 – STRENGTH OF MATERIALS LABORATORY

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	1	-	2	3	3	3
CO2	3	3	3	2	2	-	-	-	1	-	2	3	3	3
CO3	3	3	3	2	2	-	-	-	1	-	2	3	3	3
CO4	3	3	3	2	2	-	-	-	1	-	2	3	3	3
CO5	3	3	3	2	2	-	-	-	1	-	2	3	3	3
Average	3.0	3.0	3.0	2.0	2.0	-	-	-	1.0	-	2.0	3.0	3.0	3.0

16CE4002 – FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	3	2	3	3	1	1	2	3	3
CO2	3	2	-	2	1	3	3	3	3	1	-	2	2	2
CO3	3	2	1	2	1	3	2	3	3	1	1	2	3	3
CO4	3	3	3	2	1	3	2	3	3	1	2	2	3	3
CO5	3	3	3	2	1	3	2	3	3	2	1	2	3	2
Average	3.0	2.4	2.0	2.0	1.0	3.0	2.2	3.0	3.0	1.2	1.3	2.0	2.8	2.6

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