KERALA TECHNOLOGICAL UNIVERSITY

B. Tech. Syllabus

KERALA TECHNOLOGICAL UNIVERSITY

Syllabus
for
I & II Semester
B. Tech. Degree
2015

as on 01.07.2015

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Course No.	Course Name	L-T-P-Credits	Year of Introduction
MA101	CALCULUS	3-1-0-4	2015

Course Objectives

In this course the students are introduced to some basic tools in Mathematics which are useful in modelling and analysing physical phenomena involving continuous changes of variables or parameters. The differential and integral calculus of functions of one or more variables and of vector functions taught in this course have applications across all branches of engineering. This course will also provide basic training in plotting and visualising graphs of functions and intuitively understanding their properties using appropriate software packages.

Syllabus

Single Variable Calculus and Infinite series, Three dimensional space and functions of more than one variable, Partial derivatives and its applications, Calculus of vector valued functions, Multiple Integrals, Vector Integration.

Expected outcome

At the end of the course the student will be able to model physical phenomena involving continuous changes of variables and parameters and will also have acquired basic training in visualising graphs and surfaces using software or otherwise.

Text Book:

- Anton, Bivens and Davis, Calculus, John Wiley and Sons.
- Pal, S. and Bhunia, S. C., Engineering Mathematics, Oxford University Press, 2015.
- Thomas Jr., G. B., Weir, M. D. and Hass, J. R., Thomas' Calculus, Pearson.

References:

- Bali, N. P. and Goyal, M., Engineering Mathematics, Lakshmy Publications.
- Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
- Jordan, D. W. and Smith, P., Mathematical Techniques, Oxford University Press.
- Kreyszig, E., Advanced Engineering Mathematics, Wiley India edition.
- Sengar and Singh, Advanced Calculus, Cengage Learning.
- Srivastava, A. C. and Srivasthava, P. K., Engineering Mathematics Vol. 1, PHI Learning Pvt. Ltd.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Single Variable Calculus and Infinite series (Book I –sec.6.1, 6.4, 6.8, 9.3, 9.5, 9.6, 9.8)		15 %
	Introduction: Hyperbolic functions and inverses- derivatives and integrals.	3	
	Basic ideas of infinite series and convergence. Convergence tests-comparison, ratio, root tests (without proof). Absolute convergence. Maclaurins series-Taylor series - radius of convergence.	3	

	(For practice and submission as assignment only: Sketching, plotting and interpretation of exponential, logarithmic and hyperbolic functions using suitable software. Demonstration of convergence of series by software packages)	3	
II	Three dimensional space and functions of more than one variable (Book I – 11.7, 11.8, 13.1, 13.2)		15 %
	Three dimensional space; Quadric surfaces, Rectangular, Cylindrical and spherical coordinates, Relation between coordinate systems. Equation of surfaces in cylindrical and spherical coordinate systems.	4	
	Functions of two or more variables – graphs of functions of two variables- level curves and surfaces –Limits and continuity.	2	
	(For practice and submission as assignment only: Tracing of surfaces- graphing quadric surfaces- graphing functions of two variables using software packages)	2	
FIRST INTERNAL EXAM			
III	Partial derivatives and its applications(Book I –sec. 13.3 to 13.5 and 13.8)		15 %
	Partial derivatives - Partial derivatives of functions of more than two variables - higher order partial derivatives - differentiability, differentials and local linearity.	4	
	The chain rule - Maxima and Minima of functions of two variables - extreme value theorem (without proof)- relative extrema.	5	
IV	Calculus of vector valued functions(Book I-12.1-12.6, 13.6,13.7)		15 %
	Introduction to vector valued functions - parametric curves in 3-space. Limits and continuity - derivatives - tangent lines - derivative of dot and cross product- definite integrals of vector valued functions.	2	
	Change of parameter - arc length - unit tangent - normal - velocity - acceleration and speed - Normal and tangential components of acceleration.	2	
	Directional derivatives and gradients-tangent planes and normal vectors.	2	
	(For practice and submission as assignment only: Graphing parametric curves and surfaces using software packages)	4	

SECOND INTERNAL EXAM			
V	Multiple integrals (Book I-sec. 14.1, 14.2, 14.3, 14.5, 14.6, 14.7)		20 %
	Double integrals - Evaluation of double integrals - Double integrals in non-rectangular coordinates - reversing the order of integration.	3	
	Area calculated as double integral - Double integrals in polar coordinates.	2	
	Triple integrals - volume calculated as a triple integral - triple integrals in cylindrical and spherical coordinates.	2	
	Converting triple integrals from rectangular to cylindrical coordinates - converting triple integrals from rectangular to spherical coordinates - change of variables in multiple integrals - Jacobians (applications of results only)	3	
VI	Vector integration(Book I sec. 15.1, 15.2, 15.3, 15.4, 15.6, 15.7, 15.8)		20 %
	Vector and scalar fields- Gradient fields – conservative fields and potential functions – divergence and curl - the ∇ operator - the Laplacian ∇^2	3	
	Line integrals - work as a line integral- independence of path-conservative vector field.	3	
	Green's Theorem (without proof- only for simply connected region in plane), surface integrals – Divergence Theorem (without proof) , Stokes' Theorem (without proof) (For practice and submission as assignment only: graphical representation of vector fields using software packages) Green's Theorem (without proof- only for simply connected region in plane), surface integrals – flux integral - Divergence Theorem (without proof) , Stokes' Theorem (without proof) (For practice and submission as assignment only: graphical representation of vector fields using software packages)	4	
END SEMESTER EXAM			

Open source software packages such as gnuplot, maxima, scilab, geogebra or R may be used as appropriate for practice and assignment problems.

TUITORIALS: Tutorials can be ideally conducted by dividing each class in to two groups. Prepare necessary materials from each module that are to be taught using computer. Use it uniformly to every class.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
PH100	ENGINEERING PHYSICS	3-1-0-4	2015

Course Objectives

Most of the engineering disciplines are rooted in Physics. In fact a good engineer is more or less an applied physicist. This course is designed to provide a bridge to the world of technology from the basics of science and to equip the students with skills in scientific inquiry, problem solving, and laboratory techniques.

Syllabus

Harmonic Oscillations: Damped and Forced Harmonic Oscillations. Waves: One Dimensional and Three Dimensional waves, Interference: Interference in thin films (Reflected system) Diffraction: Fraunhofer and Fresnel Diffraction, Grating, Polarization of Light: Double refraction, production and detection of polarized light, Superconductivity: Properties and Applications. Quantum Mechanics: Schrodinger Equations- Formulation and Solution, Operators, Applications. Statistical Mechanics: Microstates and macro states Maxwell - Boltzmann, Bose-Einstein and Fermi Dirac statistics. Fermi level and its significance. Acoustics: Intensity of sound, Reverberation and design concepts, Ultrasonics: Production, Detection and Applications, NDT methods, Lasers: Properties, Working Principles, Practical Lasers. Photonics: Basics of Solid State lighting, Photo detectors, Solar Cells, Fiber Optics.

Expected outcome

Familiarity with the principles of Physics and its significance in engineering systems and technological advances.

References:

- Aruldhas, G., Engineering Physics, PHI Ltd.
- Beiser, A., Concepts of Modern Physics, McGraw Hill India Ltd.
- Bhattacharya and Tandon, Engineering Physics , Oxford India
- Brijlal and Subramanyam, A Text Book of Optics, S. Chand & Co.
- Dominic and Nahari, A Text Book of Engineering Physics, Owl Books Publishers
- Hecht, E., Optics, Pearson Education
- Mehta, N., Applied Physics for Engineers, PHI Ltd
- Palais, J. C., Fiber Optic Communications, Pearson Education
- Pandey, B. K. and Chathurvedi, S., Engineering Physics, Cengage Learning
- Philip, J., A Text Book of Engineering Physics, Educational Publishers
- Premlet, B., Engineering Physics, Mc GrawHill India Ltd
- Sarin, A. and Rewal, A., Engineering Physics, Wiley India Pvt Ltd
- Sears and Zemansky, University Physics , Pearson
- Vasudeva, A. S., A Text Book of Engineering Physics, S. Chand & Co

Web:

www.physics.org
www.howstuffworks.com
www.physics.about.com

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Harmonic Oscillations: Differential equation of damped harmonic oscillation, forced harmonic oscillation and their solutions- Resonance, Q factor, Sharpness of resonance- LCR circuit as an electrical analogue of Mechanical Oscillator (Qualitative)	5	15%
	Waves: One dimensional wave - differential equation and solution. Three dimensional waves - Differential equation & its solution. (No derivation) Transverse vibrations of a stretched string.	4	
II	Interference: Coherence. Interference in thin films and wedge shaped films (Reflected system) Newton's rings-measurement of wavelength and refractive index of liquid Interference filters. Antireflection coating.	5	15%
	Diffraction Fresnel and Fraunhofer diffraction. Fraunhofer diffraction at a single slit. Plane transmission grating. Grating equation - measurment of wavelength. Rayleigh's criterion for resolution of grating- Resolving power and dispersive power of grating.	4	
FIRST INTERNAL EXAM			
III	Polarization of Light: Types of polarized light. Double refraction. Nicol Prism. Quarter wave plate and half wave plate. Production and detection of circularly and elliptically polarized light. Induced birefringence- Kerr Cell - Polaroid & applications.	4	15%
	Superconductivity: Superconducting phenomena. Meissner effect. Type-I and Type-II superconductors. BCS theory (qualitative). High temperature superconductors - Josephson Junction - SQUID- Applications of superconductors.	5	
IV	Quantum Mechanics: Uncertainty principle and its applications- formulation of Time dependent and Time independent Schrödinger equations- physical meaning of wave function- Energy and momentum Operators-Eigen values and functions- One dimensional infinite square well potential .Quantum mechanical Tunnelling (Qualitative)	6	15%
	Statistical Mechanics: Macrostates and Microstates. Phase space. Basic postulates of Maxwell- Boltzmann, Bose-Einstein and Fermi Dirac	3	

	statistics. Distribution equations in the three cases (no derivation). Fermi Level and its significance.		
SECOND INTERNAL EXAM			
V	Acoustics: Intensity of sound- Loudness-Absorption coefficient - Reverberation and reverberation time- Significance of reverberation time- Sabine's formula (No derivation) -Factors affecting acoustics of a building.	4	20%
	Ultrasonics: Production of ultrasonic waves - Magnetostriction effect and Piezoelectric effect - Magnetostriction oscillator and Piezoelectric oscillator - Detection of ultrasonics - Thermal and piezoelectric methods- Applications of ultrasonics - NDT and medical.		
VI	Laser: Properties of Lasers, absorption, spontaneous and stimulated emissions, Population inversion, Einstein's coefficients, Working principle of laser,Optial resonant cavity. Ruby Laser, Helium-Neon Laser, Semiconductor Laser (qualitative). Applications of laser, holography (Recording and reconstruction)	5	20%
	Photonics: Basics of solid state lighting - LED – Photodetectors - photo voltaic cell, junction & avalanche photo diodes, photo transistors, thermal detectors, Solar cells- I-V characteristics - Optic fibre-Principle of propagation-numerical aperture-optic communication system (block diagram) - Industrial, medical and technological applications of optical fibre. Fibre optic sensors - Basics of Intensity modulated and phase modulated sensors.	5	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CY100	ENGINEERING CHEMISTRY	3-1-0-4	2015

Course Objectives

To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like new generation engineering materials, storage devices, different instrumental methods etc. And to develop abilities and skills that are relevant to the study and practice of chemistry.

Syllabus

Spectroscopy - Principles and Applications, Electrochemistry - Electrodes, Electrochemical series and applications, Nernst Equation, Potentiometric titration and application, Cells, Instrumental Methods- Thermal Analysis, Chromatography; Conductivity, Chemistry of Engineering Materials, Copolymers, Conducting Polymers, Advanced Polymers, Nano materials, Fuels and Calorific value; Lubricants and their properties, Water Technology - Hardness, Water softening methods, Sewage water Treatment.

Expected outcome

The student will be able to apply the knowledge of chemistry and will be equipped to take up chemistry related topics as part of their project works during higher semester of the course.

References Books:

- Ahad, J., Engineering Chemistry, Jai Publications
- Dara, S. S., Engineering Chemistry, S Chand Publishers
- Fernandez, A., Engineering Chemistry, Owl Book Publishers, ISBN 9788192863382
- Jain and Jain, Engineering Chemistry, Dhanpat Rai Publishers
- Kaurav, Engineering Chemistry with Laboratory Experiments. PHI, ISBN 9788120341746
- Manjooran K. S., Modern Engineering Chemistry, Kannatheri Publication
- Seymour, R. B., Introduction to Polymer Chemistry, McGraw Hill
- Rath, P., Engineering Chemistry, Cengage Learning, ISBN 9788131526699
- Wiley India, Engineering Chemistry, ISBN 9788126543205

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Spectroscopy: Introduction, Beer Lamberts Law (worked out examples)	1	15%
	UV-visible spectroscopy - Principle, Instrumentation and applications	2	
	IR spectroscopy - Principle and applications	2	
	^{1}H NMR spectroscopy - Principle, chemical shift - spin - spin splitting and applications including MRI	4	
II	Electrochemistry: Different types of electrodes (general) – SHE, Calomel electrode, Glass electrode and determination of E^0 using SHE & Calomel	2	15%

	electrode		
	Electrochemical series and its applications.	1	
	Nernst equation for an electrode- Derivation, application & numericals	2	
	Potentiometric titration - Acid-base and redox titration	2	
	Lithium ion cell and Fuel cell.	1	
FIRST INTERNAL EXAM			
III	Instrumental Methods: Thermal analysis - Principle, instrumentation and applications of TGA and DTA.	3	15%
	Chromatographic methods - Basic principles, column, TLC. Instrumentation and principles of GC and HPLC.	4	
	Conductivity - Measurement of conductivity	1	
IV	Chemistry of Engineering Materials: Copolymers - BS, ABS - Structure and Properties.	1	15%
	Conducting Polymers - Polyaniline, Polypyrrole - Preparation, Structure and Properties.	2	
	OLED – An introduction	1	
	Advanced Polymers – Kevlar, Polybutadiene rubber and silicone rubber: Preparation, Structure and Properties.	2	
	Nanomaterials – Definition, Classification, chemical methods of preparation - hydrolysis and reduction	2	
	Properties and Applications – Carbon Nano Tubes and fullerenes.	1	
SECOND INTERNAL EXAM			
V	Fuels and Lubricants: Fuels - Calorific Value, HCV and LCV - Determination of calorific value of a solid and liquid fuel by Bomb calorimeter - Dulongs formula and Numericals.	3	20%
	Liquid fuel - Petrol and Diesel - Octane number & Cetane number	1	
	Biodiesel - Natural gas.	2	
	Lubricant - Introduction, solid, semisolid and liquid lubricants.	1	
	Properties of lubricants - Viscosity Index, Flash point, Fire point, Cloud point, Pour point and Aniline point.	2	
VI	Water Technology: Types of hardness, Units of hardness, Estimation of Hardness – EDTA method. Numericals based on the above	3	20%
	Water softening methods - Ion exchange process - Principle. Polymer ion exchange.	2	
	Reverse Osmosis - Disinfection method by chlorination and UV	1	
	Dissolved oxygen, BOD and COD.	2	
	Sewage water Treatment - Trickling Filter and UASB process.	1	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE100	ENGINEERING MECHANICS	3-1-0-4	2015

Course Objectives

1. To apply the principles of mechanics to practical engineering problems.
2. To identify appropriate structural system for studying a given problem and isolate it from its environment.
3. To develop simple mathematical model for engineering problems and carry out static analysis.
4. To carry out kinematic and kinetic analyses for particles and systems of particles.

Syllabus

Statics: Fundamental concepts and laws of mechanics; Force systems; Principle of moments; Resultant of force and couple systems; Equilibrium of rigid body; Free body diagram; Equilibrium of a rigid body in three dimension; Support reactions; Properties of surfaces and solids - Centroid, Moment of inertia, Polar moment of inertia, Mass moment of inertia, Product of inertia and Principal moment of inertia; Theorems of Pappus – Guldinus; Friction; Principle of virtual work.

Dynamics: Rectangular and cylindrical coordinate system; Combined motion of rotation and translation; Newton's second law in rectilinear translation; D' Alembert's principle; Mechanical vibration; Simple harmonic motion; Spring-mass model.

Expected outcome

1. Students will be able to apply and demonstrate the concepts of mechanics to practical engineering problems.
2. Students will be able to determine the properties of planes and solids.
3. Students will be able to apply fundamental concepts of dynamics to practical problems.

Text Books:

- Shames, I. H., Engineering Mechanics - Statics and Dynamics, Pearson Prentice
- Timoshenko, S. & Young D. H., Engineering Mechanics, McGraw Hill

References Books:

- Babu, J., Engineering Mechanics, Pearson Prentice Hall
- Beer and Johnson, Vector Mechanics for Engineers - Statics and Dynamics, Tata McGraw Hill Publishing Company Limited
- Benjamin J., Engineering Mechanics, Pentex Book Publishers and Distributors
- Bhavikkatti, S. S., Engineering Mechanics, New Age International Publishers
- Hibbeler, R. C., Engineering Mechanics: Statics and Dynamics. Pearson Prentice Hall
- Kumar, K. L., Engineering Mechanics, Tata McGraw Hill Publishing Company Limited
- Merriam J. L. and Kraige L. G., Engineering Mechanics – Vol. I and II, John Wiley
- Rajasekaran S. and Sankarasubramanian, G., Engineering Mechanics, Vikas Publishing House Private Limited
- Tayal, A. K., Engineering Mechanics- Statics and Dynamics, Umesh Publications

Course Plan			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	Statics: Fundamental concepts and laws of mechanics – Rigid body – Principle of transmissibility of forces	2	15%
	Coplanar force systems - Moment of a force – Principle of moments	2	
	Resultant of force and couple system	4	
	Equilibrium of rigid body – Free body diagram – Conditions of equilibrium in two dimensions – Two force and three force members.	3	
II	Types of supports – Problems involving point loads and uniformly distributed loads only.	5	15%
	Force systems in space – Degrees of freedom – Free body diagram – Equations of equilibrium – Simple resultant and Equilibrium problems.	4	
FIRST INTERNAL EXAM			
III	Properties of planar surfaces – Centroid and second moment of area (Derivations not required) - Parallel and perpendicular axis theorem – Centroid and Moment of Inertia of composite area.	3	15%
	Polar Moment of Inertia – Radius of gyration – Mass moment of inertia of cylinder and thin disc (No derivations required).	2	
	Product of inertia – Principal Moment of Inertia (conceptual level).	3	
	Theorems of Pappus and Guldinus.	1	
IV	Friction – Characteristics of dry friction – Problems involving friction of ladder, wedges and connected bodies.	6	15%
	Definition of work and virtual work – Principle of virtual work for a system of connection bodies – Problems on determinate beams only.	4	
SECOND INTERNAL EXAM			
V	Dynamics: Rectangular and Cylindrical co-ordinate system	1	20%
	Combined motion of rotation and translation – Concept of instantaneous centre – Motion of connecting rod of piston and crank of a reciprocating pump.	4	
	Rectilinear translation – Newton's second law – D'Alembert's Principle – Application to connected bodies (Problems on motion of lift only).	4	
VI	Mechanical vibrations – Free and forced vibration - Degree of freedom.	1	20%
	Simple harmonic motion – Spring-mass model – Period – Stiffness – Frequency – Simple numerical problems of single degree of freedom.	7	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE110	*ENGINEERING GRAPHICS	1-1-2-3	2015

*As this course is practical oriented, the evaluation is different from other lecture based courses.

Points to note:

(1) End semester examination will be for 50 marks and of 2 hour duration.

(2) End semester exam will include all modules except Module IV.

(3) 100 marks are allotted for internal evaluation: first internal exam 40 marks, second internal exam 40 marks and class exercises 20 marks.

(4) The first internal exam will be based on modules I and II and the second internal exam will be a practical exam based on Module IV alone.

Course Objectives

To enable the student to be able to effectively communicate basic designs through graphical representations as per standards.

Syllabus

Introduction to Engineering Graphics; Orthographic projections of lines and solids, Isometric projection, Freehand sketching, Introduction to CAD, Sections of solids, Development of surfaces, Perspective projection.

Expected outcome

Upon successful completion of this course, the student would have accomplished the following abilities and skills:

1. Fundamental Engineering Drawing Standards.
2. Dimensioning and preparation of neat drawings and drawing sheets.
3. Interpretation of engineering drawings
4. The features of CADD software

References Books:

- Agrawal, B. and Agrawal, C. M., Engineering Drawing, Tata McGraw Hill Publishers
- Anilkumar, K. N., Engineering Graphics, Adhyuth Narayan Publishers
- Benjamin, J., Engineering Graphics, Pentex Publishers
- Bhatt, N., D., Engineering Drawing, Charotar Publishing House Pvt Ltd.
- Duff, J. M. and Ross, W. A., Engineering Design and Visualization, Cengage Learning, 2009
- John, K. C., Engineering Graphics, Prentice Hall India Publishers
- Kulkarni, D. M., Rastogi, A. P. and Sarkar, A. K., Engineering Graphics with AutoCAD, PHI 2009
- Luzadder, W. J. and Duff, J. M., Fundamentals of Engineering Drawing, PHI 1993
- Parthasarathy, N. S., and Murali, V., Engineering Drawing, Oxford University Press

<table>
<tr><td colspan="4">

- Varghese, P. I., Engineering Graphics, V I P Publishers
- Venugopal, K., Engineering Drawing & Graphics, New Age International Publishers

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<tr><td colspan="4">Course Plan</td></tr>
<tr><th>Module</th><th>Contents</th><th>Hours</th><th>Sem. Exam Marks</th></tr>
<tr><td>I</td><td>6 exercises
Introduction to Engineering Graphics: Need for engineering drawing. Drawing instruments; BIS code of practice for general engineering drawing.
Orthographic projections of points and lines:-Projections of points in different quadrants; Projections of straight lines inclined to one of the reference planes, straight lines inclined to both the planes; True length and inclination of lines with reference planes; Traces of lines.</td><td>10</td><td>20%</td></tr>
<tr><td>II</td><td>12 exercises
Orthographic projections of solids:-Projections of simple solids* in simple positions, projections of solids with axis inclined to one of the reference planes and axis inclined to both the reference planes.</td><td>09</td><td>20%</td></tr>
<tr><td colspan="4">FIRST INTERNAL EXAM</td></tr>
<tr><td>III</td><td>12 exercises
Isometric Projections:-Isometric projections and views of plane figures simple* and truncated simple* solids in simple position including sphere and hemisphere and their combinations.
Freehand sketching: Freehand sketching of real objects, conversion of pictorial views into orthographic views and vice versa.</td><td>07</td><td>20%</td></tr>
<tr><td>IV</td><td>6 exercises
Introduction to Computer Aided Drafting - familiarizing various coordinate systems and commands used in any standard drafting software - drawing of lines, circle, polygon, arc, ellipse, etc. Creating 2D drawings. Transformations: move, copy, rotate, scale, mirror, offset and array; trim, extend, fillet, chamfer. Dimensioning and text editing. Exercises on basic drafting principles, to create technical drawings. Create orthographic views of simple solids from pictorial views. Create isometric views of simple solids from orthographic views. Solid modelling and sectioning of solids, extraction of 2D drawings from solid models. (For internal examination only, not for University Examination).</td><td>14</td><td>Internal</td></tr>
<tr><td colspan="4">SECOND INTERNAL EXAM</td></tr>
<tr><td>V</td><td>9 exercises</td><td>10</td><td>20%</td></tr>
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	Sections and developments of solids: - Sections of simple* solids in simple vertical positions with section plane inclined to one of the reference planes - True shapes of sections. Developments of surfaces of these solids.		
VI	6 exercises Intersection of surfaces: - Intersection of prism in prism and cylinder in cylinder - axis bisecting at right angles only. Perspective projections: - perspective projections of simple* solids.	06	20%
*Triangular, square, pentagonal and hexagonal prisms, pyramids, cones and cylinders. Note: First angle projection to be followed.			
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-01	INTRODUCTION TO CIVIL ENGINEERING	2-1-0-3	2015

Course Objectives

1. To provide the students an overview of the profession of Civil Engineering.
2. To give the students an illustration of the use and properties of various building materials and explain the building construction aspects.

Syllabus

Civil Engineering as a profession; General introduction to history of Civil Engineering; types and classification of buildings; setting out of a building; Building materials - Stones, Bricks, Tiles, Cement, Aggregate, Cement mortar, Timber, Steel; Building Construction - Stone Masonry, Brick Masonry, Floors and flooring, Roofs and roof coverings.

Expected outcome

1. Students will be able to explain the importance of Civil Engineering in the infrastructural development of the society.
2. They will be able to illustrate the types, uses and properties of various building materials.
3. Students will be able to explain the method of construction of different components of a building.

References Books:

- Chen, W. F. and Liew, J. Y. R., (Eds.), The Civil Engineering Handbook, Second Edition, CRC Press (Taylor and Francis)
- Dalal, K. R., Essentials of Civil Engineering, Charotar Publishing House
- Gopi, S., Basic Civil Engineering, Pearson Publishers
- Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
- Mamlouk, M. S. and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers.
- McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
- Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house
- Rangwala, S. C. and Dalal, K. B., Building Construction, Charotar Publishing house

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	General introduction to Civil Engineering - History of Civil Engineering - Relevance of Civil Engineering in the overall infrastructural development of the country.	2	15%
	Types and classification of structures - buildings, towers, chimneys, bridges, dams, retaining walls, water tanks, silos, roads, railways,	3	

	runways and pipelines (Brief description only)		
	Definition and types of buildings as per National Building Code of India (brief description only).	1	
	Selection of site - Components of a building and their functions - Setting out of a building.	2	
II	Stones: Classification of stones - Qualities of good building stones - Quarrying - Dressing - Tests - Specifications - Uses of common building stones.	2	15%
	Bricks: Composition of good brick earth - Classification - Qualities of good bricks - Field and laboratory tests - Specifications.	2	
	Tiles: Classification - Manufacture - Properties - Tests - Specifications	3	
FIRST INTERNAL EXAM			
III	Cement: Basic Ingredients – Manufacturing process - Grades - Properties - Tests - Specifications.	4	15%
	Aggregates: Fine and coarse aggregate - Properties - Uses - Tests.	3	
	Cement Mortar: Types and preparation.	1	
IV	Stone Masonry: Types - Details of Ashlar, Random Rubble, Coarse Rubble and Dry Rubble Masonry.	3	15%
	Brick Masonry: Types - Bond - Introduction to all types of bonds - English bond in detail (1, 1½ and 2 brick walls) - Comparison of stone and brick masonry.	4	
SECOND INTERNAL EXAM			
V	Timber: Properties - Uses - Classification - Seasoning - Defects - Preservation - Tests; Hard board and Particle board - Manufacture and use.	3	20%
	Steel: Structural steel and steel as reinforcement - Types - Properties - Uses - Market forms.	3	
VI	Floors and Flooring materials: Different types and selection of floors and floor coverings.	3	20%
	Roofs and roof coverings: Different types of roofs - Suitability - Types and selection of roofing materials.	3	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-02	INTRODUCTION TO MECHANICAL ENGINEERING SCIENCES	2-1-0-3	2015

Course Objectives

1. To introduce different disciplines of Mechanical Engineering
2. To kindle interest in Mechanical Engineering
3. To impart basic mechanical engineering principles

Syllabus

Thermodynamics & Power sources, Thermal Engineering, Refrigeration and Air Conditioning, Automobile & Aeronautical Engineering, Mechanisms & Machines, Materials and manufacturing.

Expected outcome

At the end of the course, the students will have exposed to the different areas of Mechanical Engineering; gained idea about nature, scope and applications of Mechanical Engineering principles.

References Books:

- Dossat, R. J., Principles of Refrigeration, PHI
- Heywood, J., Internal Combustion Engine Fundamentals, McGraw Hill Publishers
- Holman, J. P., Thermodynamics, McGraw Hill Co.
- Jain, K. K. and Asthana, R. B., Automobile Engineering, TTTI Bhopal
- Kalpakjian, S. and Schmid, S. R., Manufacturing Processes for Engineering Materials, Pearson education
- Maines, R., Landmarks in Mechanical Engineering, ASME
- Menon, R. V. G., The Development of Science & Technology.
- Peng, W. W., Principles of Turbomachinery, John Wiley & Sons
- Pita, E. G., Air Conditioning Principles & Systems, PHI
- Shigley, J. E. and Uicker, J. J., Theory of Machines & Mechanisms, Oxford University Press
- Shigley, J. E., Mechanical Engineering Design, McGraw Hill Publishers
- Spalding, D. B. and Cole, E. H., Engineering Thermodynamics, ELBS & Edward Arnold (Pub) Ltd.
- Stone, R. and Ball, T. K., Automotive Engineering Fundamentals, SAE International
- Sutton, G. P. and Ross, D. M., Rocket Propulsion Elements, John Wiley & Sons
- Von Karman, T., Aerodynamics: Selected Topics in the Light of Their Historical Development, Courier Corporation
- Online course on Refrigeration & Air conditioning, IIT Kharagpur www.nptel.ac.in

Course Plan			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	**Thermodynamics**: Nature and scope of thermodynamics; Basic concepts ; Laws of thermodynamics- Discovery, Significance & Applications; Qualitative ideas on Entropy, Available energy, Irreversibility, Clausius Inequality, Principle of increase of entropy & Carnot engine; Limitations of Thermodynamics; Sources of power; history of power production; power production in the future.	7	15%
II	**Thermal Engineering:** Historical development of steam engine, steam turbines, gas turbines and hydraulic turbines; Principle of turbomachinery; History of IC engines; two stroke and four stroke engines-working, applications; Air compressors- types and uses; Principles of Rocket propulsion, chemical rockets, Indian space programme	7	15%
FIRST INTERNAL EXAM			
III	**Refrigeration & Air Conditioning:** History & scope of refrigeration; applications of refrigeration; Food preservation, refrigerated storage; applications in chemical and process industries; special applications; Air conditioning- Principles & systems; scope of air conditioning; Components of A/c systems, all-air and all-water A/c systems;, Psychrometric properties of air; Human comfort; comfort standards.	7	15%
IV	**Automobile & Aeronautical Engineering**: Introduction to an Automobile; history of the automobile; Indian Automobiles; Types of automobiles; Layout of an automobile; Major components and their functions; Manufacturers of motor vehicles in India; Fundamentals of aerodynamics; theory of lift and drag; aircraft engines-types and applications.	7	15%
SECOND INTERNAL EXAM			
V	**Mechanisms & Machines:** Introduction; Analysis and synthesis; terminology; definitions & assumptions; planar, spherical and spatial mechanisms, examples of mechanisms; mobility; classification of mechanisms; Grashof's law; mechanical advantage; Mechanical Engineering design; types of design; design considerations; types of loads; factor of safety; codes & standards; economics of design; reliability; safety.	7	20%
VI	**Manufacturing Engineering & Materials:** Introduction and history of	7	20%

	materials and manufacturing; engineering materials; metals, alloys, composites, microstructures, heat treatment, physical properties of materials and material testing; methods of manufacturing; examples of manufactured products; Computer Integrated manufacturing; lean production & agile manufacturing; environmentally conscious design & manufacturing; organization for manufacture.		
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-03	INTRODUCTION TO ELECTRICAL ENGINEERING	2-1-0-3	2015

Course Objectives

The objective of this course is to set a firm and solid foundation in Electrical Engineering with strong analytical skills and conceptual understanding of basic laws and analysis methods in electrical and magnetic circuits.

Syllabus

Fundamental Concepts of Circuit Elements and Circuit variables, Real and Ideal independent voltage and current sources, V-I relations; Basic Circuit Laws, Analysis of resistive circuits, Magnetic Circuits, Electromagnetic Induction; Alternating current fundamentals, Phasor Concepts, Complex representation, Phasor analysis of RL, RC, RLC circuit, admittances; Complex Power, Resonance in series and parallel circuits; Three-phase systems, analysis of balanced and unbalanced star and delta connected loads; Wiring systems, Earthing, Protective devices.

Expected outcome

The course will enable students to learn advanced topics in Electrical Engineering.

References Books:

- Bhattacharya, S. K., Basic Electrical & Electronics Engineering, Pearson
- Bird, J., Electrical Circuit Theory and Technology, Routledge, Taylor & Francis Group
- Edminister, J., Electric Circuits, Schaum's Outline Series, Tata McGraw Hill
- Hayt, W. H., Kemmerly, J. E., and Durbin, S. M., Engineering Circuit Analysis, Tata McGraw Hill
- Hughes, Electrical and Electronic Technology, Pearson Education
- Parker and Smith, Problems in Electrical Engineering, CBS Publishers and Distributors
- Sudhakar and Syam Mohan, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill
- Suresh Kumar, K. S, Electric Circuits and Networks, Pearson Education

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Fundamental Concepts of Circuit Elements and Circuit variables: Electromotive force, potential and voltage. Resistors, Capacitors, Inductors- terminal V-I relations. Basic Circuit Laws: Kirchhoff's current and voltage laws, analysis of resistive circuits - mesh, node analysis, super mesh and super node analysis. Star delta transformation. Numerical problems.	6	15%
II	Magnetic Circuits: Magneto motive force, flux, reluctance, permeability-	9	15%

	comparison of electric and magnetic circuits analysis of series and parallel magnetic circuits, magnetic circuits with air-gaps. Electromagnetic Induction: Faraday's laws, Lenz's law, statically and dynamically induced emf, self and mutual inductance, coupling coefficient. Real and Ideal independent voltage and current sources, V-I relations. Passive sign convention. Numerical problems.		
FIRST INTERNAL EXAM			
III	Alternating current fundamentals: Frequency, Period, RMS and average values, peak factor and form factor of periodic waveforms (pure sinusoidal and composite waveforms). Phasor Concepts, Complex representation (exponential, polar and rectangular forms) of sinusoidal voltages and currents, phasor diagrams, Complex impedance - series and parallel impedances and admittances. Phasor analysis of RL, RC, RLC circuits. Numerical problems.	9	**15**%
IV	Complex Power: Concept of power factor - active, reactive power and apparent power. Resonance in series and parallel circuits: Energy, bandwidth and quality factor, variation of impedance and admittance in series and parallel resonant circuits. Numerical problems.	5	**15**%
SECOND INTERNAL EXAM			
V	Three-phase systems: Star and delta connections, three-phase three wire and three-phase four-wire systems, analysis of balanced and unbalanced star and delta connected loads, power in three-phase circuits. Active and Reactive power measurement by one, two, and three wattmeter methods. Numerical problems.	8	**20**%
VI	Wiring systems: Basic concepts of wiring (conduit wiring only), service mains, meter board and distribution board. Earthing: Earthing of installations - necessity of earthing, plate & pipe earthing. Protective devices: protective fuses, MCB, ELCB.	5	**20**%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-04	INTRODUCTION TO ELECTRONICS ENGINEERING	2-1-0-3	2015

Course Objectives

1. To get basic idea about types, specification and common values of passive components
2. To familiarize the working and characteristics of diodes, transistors and MOSFETS
3. To understand working of diodes in circuits and in rectifiers
4. To familiarize some measuring instruments

Syllabus

Evolution and Impact of Electronics, Familiarization of Resistors, Capacitors, Inductors, Transformers and Electro mechanical components, Semiconductors, PN junction diode, Zener diode, LED, photo diode, Bipolar Junction Transistors: Structure, principle of operation, different configurations, load line and operating point, biasing and stabilization, Transistor as amplifier, switch, Junction Field Effect Transistors: Structure, principle of operation, characteristics MOSFET: Structure, principle of operation, characteristics, Principle of operation of Photo transistor, UJT, SCR, Diode circuits and power supplies: Series and parallel diode circuits, Half-wave & full wave rectifiers, capacitor filter, zener voltage regulator, Electronic Measurements and measuring Instruments: Performance parameters, Analog and digital multimeter, CRO, DSO, function generator, Testing of Electronic components.

Expected outcome

Student can identify the active and passive electronic components and can design and setup simple circuits using diodes and transistors. Voltage and currents can be measured and monitored using electronic measuring instruments

References Books:

- Bell, D. A., Electronic Devices and Circuits, Oxford University Press
- Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education
- Kal, S., Basic Electronics: Devices, Circuits and its Fundamentals, PHI Learning
- Millman, J., Halkias, C. and Parikhu, C. D., Integrated Electronics, Tata Mc Graw Hill
- Neaman, D. A., Electronic Circuits Analysis and Design, McGraw Hill
- Sedra, A. S. and Smith, K. C., Microelectronic Circuits, Oxford University Press

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Evolution of Electronics, Impact of Electronics in industry and in society.	1	15%
	Resistors, Capacitors: types, specifications. Standard values, marking, colour coding.	3	
	Inductors and Transformers: types, specifications, Principle of working.	2	

	Electro mechanical components: relays and contactors.	1	
II	Diodes: Intrinsic and extrinsic semiconductors, PN junction diode, barrier potential, V-I characteristics, Effect of temperature. Equivalent circuit of a diode. Piece wise linear model.	3	15%
	Specification parameters of diodes and numbering.	1	
	Zener diode, Varactor diodes, characteristics, working principle of LED, photo diode, solar cell.	3	
FIRST INTERNAL EXAM			
III	Bipolar Junction Transistors: Structure, typical doping, Principle of operation, concept of different configurations. Detailed study of input and output characteristics of common base and common emitter configuration, current gain, comparison of three configurations.	3	15%
	Concept of load line and operating point. Need for biasing and stabilization, voltage divider biasing, Transistor as amplifier, switch, RC coupled amplifier and frequency response	3	
	Specification parameters of transistors and type numbering	1	
IV	Junction Field Effect Transistors: Structure, principle of operation, characteristics, comparison with BJT.	2	15%
	MOSFET: Structure, principle of operation of Enhancement type MOSFET, Current voltage characteristics, Depletion-type MOSFET.	2	
	Principle of operation of Photo transistor, UJT, SCR.	3	
SECOND INTERNAL EXAM			
V	Diode circuits and power supplies: Series and parallel diode circuits, Clippers, Clampers, Voltage multipliers	3	20%
	Half-wave and full wave (including bridge) rectifiers, Derivation of V_{rms}, V_{dc}, ripple factor, peak inverse voltage, rectification efficiency in each case, capacitor filter, working and design of a simple zener voltage regulator. Block diagram description of a DC Power supply, Principle of SMPS	4	
VI	Electronic Measurements and measuring Instruments.	2	20%
	Generalized performance parameters of instruments: error, accuracy, sensitivity, precision and resolution. Principle and block diagram of analog and digital multimeter, Block diagram of CRO, Measurements using CRO, Lissajous patterns, Principle and block diagram of DSO, function generator.	4	
	Testing of Electronic components.	1	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-05	INTRODUCTION TO COMPUTING AND PROBLEM SOLVING	2-1-0-3	2015

Course Objectives

1. To learn basics of digital computers
2. To develop problem solving skills
3. To learn programming and to solve problems using computers

Syllabus

Introduction to digital computer, Introduction to programming languages, Operating systems, Problem Solving strategies, Examples for algorithms and flow charts, Introduction to Python language, functions, parameters and arguments, Boolean Expressions, logical operators and control statements Strings, lists, tuples and dictionaries, operations, Files, introduction to objects, attributes and instances

Expected outcome

1. Ability to design algorithmic solution to problems.
2. Ability to convert algorithms to Python programs.
3. Ability to design modular Python programs using functions
4. Ability to design programs with Interactive Input and Output, utilizing arithmetic expression repetitions, decision making, arrays.
5. Ability to design programs using file Input and Output.
6. Ability to develop recursive solutions.

Text Books:

- Downey, A. et al., How to think like a Computer Scientist: Learning with Python, John Wiley, 2015
- Goel, A., Computer Fundamentals, Pearson Education
- Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, 2015
- Rajaraman, V., Computer Basics and C Programming, Prentice-Hall India

References Books:

- Barry, P., Head First Python, , O' Reilly Publishers
- Dromy, R. G., How to solve it by Computer, Pearson India
- Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson India
- Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015
- Sprankle , M., Problem Solving & Programming Concepts, Pearson India
- Venit, S. and Drake, E., Prelude to Programming: Concepts & Design, Pearson India
- Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc.

Web links:

- https://archive.org/details/MIT6.00SCS11
- https://www.coursera.org/course/pythonlearn

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	**Introduction to digital computer –** Von Neumann concept – A simple model of computer, acquisition of data, storage of data, processing of data, output of processed data. Details of functional units of a computer. Storage – primary storage and secondary storage. *(The discussion should focus more on the functionalities of the units and their interaction than on specific hardware details. However, concepts like memory cells and their addressability (need not be binary), registers, inter-connections (buses) have to introduced at an abstract level. For storage devices – primary and secondary –, various categories have to be introduced along with their distinguishing features. For I-O devices also, various categories are to be introduced. The Von Neumann concept should be effectively introduced. History computers need not be taught. However, students have to be encouraged to read the relevant sections of the text book. Chapters 1 – 4 of 'Goel' may be used to support teaching -learning.)* **Introduction to programming languages:-** types of programming languages - high level language , assembly language and machine language, System software - Operating systems – objectives of operating systems, compiler, assembler and interpreter. *(For all the above topics, focus should be more on the concepts, significance and objectives. Chapter 6 and 7 (up to 7.4) of 'Goel' may be used to support the teaching-learning process.)*	8	15%
II	**Problem Solving strategies –** Problem analysis – formal definition of problem – Solution – top- down design – breaking a problem into sub problems- overview of the solution to the sub problems by writing step by step procedure (algorithm) - representation of procedure by flowchart - Implementation of algorithms – use of procedures to achieve modularity. *(For this part the instructor has to initially use suitable analogies of real world problems to explain the concepts, before delving into computer-solvable problems.)* **Examples for algorithms and flow charts** - at least 10 problems (starting	8	15%

	with non-numerical examples, and numeric problems like factorial, largest among three numbers, largest among N, Fibonacci *etc.; to be introduced with progressive levels of difficulty*) must be discussed in detail. *(Class assignments and/or tutorials may be used to strengthen understanding of this part. Chapters 4 and 5 of the 'Rajaraman' may be used for the teaching-learning process.)*		
FIRST INTERNAL EXAM			
III	**Introduction to *Python* –** variables, expressions and statements, evaluation of expressions, precedence, string operations *(Note:- the instructor can demonstrate simple programs to the students and encourage them to develop similar ones. In particular, before attempting programs containing functions, the students should be given enough support and time to develop python code containing long sequence of statements for the simple flowcharts developed earlier. This will strengthen the students' understanding of instruction sequencing. Chapters 1 and 2 of 'Downey' have to be covered. Chapter 1 & 2 of 'Lambert' can also be used.)* Control statements, Boolean expressions and logical operators, conditional and alternative executions *(Note: - Chapter 4 of 'Downey' up to Section 4.9 has to be covered. The instructor should demonstrate each of these concepts with real examples and encourage students to develop as many as possible. Chapter 3 of 'Lambert' can be used for detailed discussion and self-study)* Iteration - *while* statement and tables. *(Note: - Chapter 6 of 'Downey' has to be covered. Chapter 3 of 'Lambert' can be used for detailed discussion and self-study.)*	8	15%
IV	Functions, calling functions, type conversion and coercion, composition of functions, mathematical functions, user-defined functions, parameters and arguments. *(Note: - Chapter 3 of 'Downey' has to be covered. The instructor should demonstrate each aspect of the function with real examples and encourage students to develop their own. Chapter 6 (up to 6.3) of 'Lambert' can be used for detailed discussion and self-study.)*	6	15%
SECOND INTERNAL EXAM			
V	Strings and lists – string traversal and comparison with examples. *(Note: - Chapter 7 of 'Downey' has to be covered. Section 4.1 of 'Lambert' can be used for detailed discussion and self-study.)* List operations with examples *(Note: - Chapter 8 of 'Downey' up to Section 8.6 has to be covered. Section 5.1 of 'Lambert' can be used for detailed discussion and self-study.)*; tuples and dictionaries – operations and examples *(Note: -*	6	20%

	Chapters 9 & 10 of the third text have to be covered. Section 5.4 of 'Lambert' can be used for detailed discussion and self-study.)		
VI	Files and exceptions - text files, directories *(Note: - Chapter 11 of 'Downey' has to be covered)* Introduction to classes and objects - attributes, instances *(Note: - Chapter 12 of 'Downey' up to Section 12.6 has to be covered)*	6	20%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE101-06	INTRODUCTION TO CHEMICAL ENGINEERING	2-1-0-3	2015

Course Objectives

1. To instil in students the interest, excitement, and urge to learn the subject of Chemical Engineering
2. To introduce the profession of Chemical Engineering
3. To introduce the purpose of learning important subjects in Chemical Engineering for meeting the requirement of various professional fields in Chemical Engineering.

Syllabus

Introduction to Chemical Engineering, profession, plant operation, Basic concepts of units and equations of state, Overview of unit operations and processes, Modes of heat transfer, chemical reactions, DCDA process, basic concepts of P&I diagram. Introduction to process instrumentation and control, Introduction to safety in chemical process industries, introduction to Environmental Engineering, Challenges of Chemical Engineer, Introduction to novel materials and their development.

Expected outcome

The student will demonstrate the ability to understand the basic concepts of Chemical Engineering

References Books:

- Badger and Banchero, Introduction to Chemical Engineering, McGraw Hill
- McCabe, W. L., Smith, J.C. and Harriott, P., Unit Operations in Chemical Engineering, McGraw Hill
- Pushpavanam, S., Introduction to Chemical Engineering, PHI Learning Pvt. Ltd.
- Smith, R., Chemical Process Design and Integration, Wiley

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Chemical Engineering: history of Chemical Engineering, role of Chemical Engineering– a broad overview; chemical industries in India; introduction to Chemical Engineering profession; introduction to chemical plant operation; process development and process design.	6	15%
II	Basic concepts: units and dimensions, systems of units, conversion and conversion factors of units, concept of mole, weight percent, mole percent, normality, molarity, molality, vapor pressure, partial pressure, concept of ideal gas and equations of state.	7	15%
	FIRST INTERNAL EXAM		
III	Overview of unit operations such as distillation, evaporation, absorption,	8	15%

	adsorption, extraction, crystallization, drying, leaching, size separation and size reduction. Overview of unit processes like saponification, polymerization, biodiesel formation and hydrogenation.		
IV	Modes of heat transfer-principles of conduction, convection and radiation, heat exchangers. Fluid flow- laminar and turbulent flow. Introduction to transportation of fluids. Classification of chemical reactions, order of reaction, rate equation, Arrhenius equation, conversion and yield, batch reactor, mixed reactor and plug flow reactor.	8	15%
SECOND INTERNAL EXAM			
V	Block diagram, process flow diagram for DCDA process for Sulphuric acid manufacture, basic concepts of P&I diagram. Introduction to process instrumentation and control: common methodologies of measurements, measuring instruments: thermocouple, venturimeter, U-tube manometer, elements of feedback control loop, introduction to control of a distillation column.	7	20%
VI	Introduction to safety in chemical process industries – basic concepts, Case study: Bhopal gas tragedy. Introduction to Environmental Engineering - basic concepts, Typical wastewater, air and solid waste management system.Case study: Effect of Aerial Spraying of Endosulfan on Residents of Kasargod, Kerala. Challenges of Chemical Engineer –need for sustainable alternatives for processes; products with environment friendly life-cycle. Introduction to novel materials and their development.	6	20%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE103	INTRODUCTION TO SUSTAINABLE ENGINEERING	2-0-1-3	2015

Course Objectives

- To have an increased awareness among students on issues in areas of sustainability
- To understand the role of engineering and technology within sustainable development;
- To know the methods, tools, and incentives for sustainable product-service system development
- To establish a clear understanding of the role and impact of various aspects of engineering and engineering decisions on environmental, societal, and economic problems.

Syllabus

Sustainability- need and concept, challenges, Environment acts and protocols, Global, Regional and Local environmental issues, Natural resources and their pollution, Carbon credits, Zero waste concept ISO 14000, Life Cycle Analysis, Environmental Impact Assessment studies, Sustainable habitat, Green buildings, green materials, Energy, Conventional and renewable sources, Technology and sustainable development, Sustainable urbanization, Industrial Ecology.

Expected outcome

The student will be

- Able to understand the different types of environmental pollution problems and their sustainable solutions
- Able to work in the area of sustainability for research and education
- Having a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course

Reference Books:

- Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
- Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
- Environment Impact Assessment Guidelines, Notification of Government of India, 2006
- Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
- ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
- Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
- Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).

• Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios publication			
Course Plan			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act.	L4	15%
	Students may be assigned to do at least one project eg: a) Identifying/assessment of sustainability in your neighbourhood in education, housing, water resources, energy resources, food supplies, land use, environmental protection etc. b) Identify the threats for sustainability in any selected area and explore solutions for the same	P1	
II	Air Pollution, Effects of Air Pollution; Water pollution- sources, Sustainable wastewater treatment, Solid waste - sources, impacts of solid waste, Zero waste concept, 3 R concept. Global environmental issues- Resource degradation, Climate change, Global warming, Ozone layer depletion, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print.	L6	15%
	Students may be assigned to do at least one project for eg: a) Assessing the pollution status of a small area b) Programmes for enhancing public environmental awareness c) Observe a pond nearby and think about the different measures that can be adopted for its conservation	P3	
FIRST INTERNAL EXAM			
III	Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking, Environment Impact Assessment (EIA) - Procedures of EIA in India.	L4	15%
	Students may be assigned to do at least one project eg: a) Conducting LCA of products (eg. Aluminium cans, PVC bottles, cars etc. or activities (Comparison of land filling and open burning) b) Conducting an EIA study of a small project (eg. Construction of a building)	P2	

IV	Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainable cities, Sustainable transport.	L5	15%
	Students may be assigned to do at least one project eg: a) Consider the design aspects of a sustainable building for your campus b) Explore the different methods that can be adopted for maintaining a sustainable transport system in your city.	P2	
SECOND INTERNAL EXAM			
V	Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy.	L5	20%
	Students may be assigned to do at least one project eg: a) Find out the energy savings that can be achieved by the installation of a solar water heater b) Conduct a feasibility study for the installation of wind mills in Kerala	P2	
VI	Green Engineering, Sustainable Urbanisation, industrialisation and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.	L5	20%
	Students may be assigned to do a group project eg: a) Collect details for instances of climate change in your locality b) Find out the carbon credits you can gain by using a sustainable transport system (travelling in a cycle or car pooling from college to home) c) Have a debate on the topics like: Industrial Ecology is a Boon or Bane for Industries?/Are we scaring the people on Climate Change unnecessarily?/Technology enables Development sustainable or the root cause of unsustainability?	P3	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CE100	BASICS OF CIVIL ENGINEERING	2-1-0-3	2015

Course Objectives

1. To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
2. To provide the students an illustration of the significance of the Civil Engineering Profession in satisfying societal needs.

Syllabus

General introduction to Civil Engineering - Introduction to types of buildings, Components of a residential building, Introduction to industrial buildings; Introduction to planning of residential buildings - Simple building plans; Introduction to the various building area terms; Setting out of a building; Surveying – Principles, Objectives, Horizontal measurements with tapes, Ranging; Levelling – Instruments, Reduction of levels; Modern surveying instruments; Building materials – Bricks, cement blocks, Cement, Cement mortar, Steel; Building construction – Foundations, Brick masonry, Roofs, Floors, Decorative finishes, Plastering, Paints and Painting; Basic infrastructure and services – Elevators, Escalators, Ramps, Air conditioning, Sound proofing, Towers, Chimneys, Water Tanks; Intelligent buildings.

Expected outcome

1. The students will be able to illustrate the fundamental aspects of Civil Engineering.
2. The students will be able to plan and set out a building.
3. Students will be able to explain the concepts of surveying for making horizontal and vertical measurements.
4. They will able to illustrate the uses of various building materials and explain the method of construction of different components of a building.
5. Students will be able to discuss about various services in a building.

References Books:

- Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
- Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
- Gopi, S., Basic Civil Engineering, Pearson Publishers
- Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
- Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers

- McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
- Minu, S., Basic Civil Engineering, Karunya Publications
- Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
- Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house
- Rangwala, S. C. and Dalal, K. B., Building Construction, Charotar Publishing house

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	General Introduction to Civil Engineering - Various disciplines of Civil engineering, Relevance of Civil engineering in the overall infrastructural development of the country.	2	15%
	Introduction to types of buildings as per NBC; Selection of site for buildings.	2	
	Components of a residential building and their functions. Introduction to industrial buildings – office / factory / software development office / power house /electronic equipment service centre (any one related to the branch of study)	2	
	Students have to visit one such building and submit an assignment about the features of any one of the listed building related to their branch (Not included for exam).	1	
II	Building planning - Introduction to planning of residential buildings- Site plan, Orientation of a building, Open space requirements, Position of doors and windows, Size of rooms; Preparation of a scaled sketch of the plan of a single storeyed residential building in a given site plan.	4	15%
	Introduction to the various building area terms - Computation of plinth area / built up area, Floor area / carpet area - for a simple single storeyed building; Setting out of a building.	3	
FIRST INTERNAL EXAM			
III	Surveying - Principles and objectives of surveying;	1	15%
	Horizontal measurements – instruments used – tape, types of tapes; Ranging (direct ranging only) – instruments used for ranging.	3	
	Levelling - Definitions, principles, Instruments (brief discussion only) - Level field book - Reduction of levels - problems on levelling (height of collimation only).	3	
	Modern surveying instruments – Electronic distance meter, digital level, total station, GPS (Brief discussion only).	1	
IV	Building materials - Bricks, cement blocks - Properties and specifications.	2	15%

	Cement – OPC, properties, grades; other types of cement and its uses (in brief).	1	
	Cement mortar – constituents, preparation.	1	
	Concrete – PCC and RCC – grades.	1	
	Steel - Use of steel in building construction, types and market forms.	1	
SECOND INTERNAL EXAM			
V	Building construction – Foundations; Bearing capacity of soil (definition only); Functions of foundations, Types - shallow and deep (sketches only).	2	20%
	Brick masonry – header and stretcher bond, English bonds – Elevation and plan (one brick thick walls only).	2	
	Roofs – functions, types, roofing materials (brief discussion only).	1	
	Floors – functions, types; flooring materials (brief discussion only).	1	
	Decorative finishes – Plastering – Purpose, procedure.	1	
	Paints and Painting – Purpose, types, preparation of surfaces for painting (brief discussion only).	2	
VI	Basic infrastructure and services - Elevators, escalators, ramps, air conditioning, sound proofing (Civil engineering aspects only)	2	20%
	Towers, Chimneys, Water tanks (brief discussion only).	1	
	Concept of intelligent buildings.	2	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
ME100	BASICS OF MECHANICAL ENGINEERING	2-1-0-3	2015

Course Objectives

To expose the students to the thrust areas in Mechanical Engineering and their relevance by covering the fundamental concepts.

Syllabus

Thermodynamics, laws of thermodynamics, implications, cycles, energy conversion devices, steam and water machines, engines, turbo machines, refrigeration and air conditioning, power transmission devices in automobiles, latest trends, engineering materials and manufacturing processes, types of materials, alloys, shape forming methods, machine tools.

Expected outcome

The student will be able to understand the inter dependence of the thrust areas in Mechanical Engineering and their significance leading to the development of products, processes and systems.

References Books:

- Balachandran, Basic Mechanical Engineering, Owl Books
- Benjamin, J., Basic Mechanical Engineering, Pentex Books
- Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press
- Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi
- Gill, Smith and Zuirys, Fundamentals of IC Engines, Oxford and IBH publishing company Pvt. Ltd. New Delhi. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi.
- Nag, P. K., Basic and Applied Thermodynamics, Tata McGraw-Hill
- Pravin Kumar, Basic Mechanical Engineering
- Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd., Mumbai.
- Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Thermodynamics: Laws of Thermodynamics, significance and applications of laws of thermodynamics; entropy, available energy; Clausius inequality; principle of increase of entropy; Ideal and real gas equations; Analysis of Carnot cycle, Otto cycle , Diesel cycle and Brayton cycle; Efficiency of these cycles.	7	15%
II	Energy conversion devices: Boilers, Steam turbines, Gas turbines and Hydraulic turbines; Working principle of two stroke and four stroke I.C.	7	15%

	Engines (Diesel and Petrol), Reciprocating and centrifugal pumps, rotary pumps, reciprocating and centrifugal compressors, fans, blowers, rotary compressors; Air motor.		
FIRST INTERNAL EXAM			
III	Refrigeration and Air Conditioning: Vapour compression and absorption refrigeration systems, COP, Study of household refrigerator, Energy Efficiency Rating, Psychrometry, Psychrometric processes, window air conditioner, split air conditioner. Ratings and selection criteria of above devices. Refrigerants and their impact on environment.	7	15%
IV	Engines and Power Transmission Devices in Automobiles, Different types of engines used in automobiles, types of automobiles; major components and their functions (Description only); Fuels; Recent developments: CRDI, MPFI, Hybrid engines. Belts and belt drives; Chain drive; Rope drive; Gears and gear trains; friction clutch (cone and single plate), brakes (types and applications only); Applications of these devices.	7	15%
SECOND INTERNAL EXAM			
V	Materials and manufacturing processes: Engineering materials, Classification, properties, Alloys and their Applications; Casting, Sheet metal forming, Sheet metal cutting, Forging, Rolling, Extrusion, Metal joining processes - Powder metallurgy.	7	20%
VI	Machine Tools (Basic elements, Working principle and types of operations) Lathe – Centre Lathe, Drilling Machine – Study of Pillar drilling machine, Shaper, planer, slotter, Milling Machine, Grinding machine, Power saw; Introduction to NC and CNC machines.	7	20%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EE100	BASICS OF ELECTRICAL ENGINEERING	2-1-0-3	2015

Course Objectives

To impart a basic knowledge in Electrical Engineering with an understanding of fundamental concepts.

Syllabus

Elementary concepts of electric circuits, Kirchhoff's laws, constant voltage and current sources, Matrix representation; Magnetic circuits, energy stored in magnetic circuits, Electromagnetic induction, Alternating current fundamentals; AC Circuits, Phasor representation of alternating quantities- rectangular, polar and exponential forms; Three phase systems, star and delta connection; Generation of power, Power transmission and distribution; Transformers, Electric Machines- D.C. Machines, AC Motors; Tariff, Wiring systems, Lamps.

Expected outcome

The course will enable the students to gain preliminary knowledge in basic concepts of Electrical Engineering.

References Books:

- Bhattacharya, S. K., Basic Electrical & Electronics Engineering, Pearson
- Bird, J., Electrical Circuit Theory and Technology, Routledge, Taylor & Francis Group
- Del Toro, V., Electrical Engineering Fundamentals, Prentice Hall of India.
- Hayt, W. H., Kemmerly, J. E., and Durbin, S. M., Engineering Circuit Analysis, Tata McGraw Hill
- Hughes, Electrical and Electronic Technology, Pearson Education
- Mehta, V. K. and Mehta, R., Basic Electrical Engineering, S. Chand Publishing
- Parker and Smith, Problems in Electrical Engineering, CBS Publishers and Distributors
- Sudhakar and Syam Mohan, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill
- Suresh Kumar, K. S, Electric Circuits and Networks, Pearson Education

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Elementary concepts of electric circuits: Kirchhoff's laws, constant voltage and current sources, formation of network equations by node voltage and mesh current methods. Matrix representation - solution of network equations by matrix methods, star-delta conversion (Analysis of resistive networks only). Numerical problems.	6	15%

II	Magnetic circuits: MMF, field strength, flux density, reluctance, energy stored in magnetic circuits. Electromagnetic induction: Faraday's laws, Lenz's law-statically induced and dynamically Induced emfs- self-inductance and mutual inductance, coefficient of coupling. Alternating current fundamentals: Generation of alternating voltages, waveforms frequency, period, average and RMS values and form factor. Numerical problems.	9	15%
FIRST INTERNAL EXAM			
III	AC Circuits: Phasor representation of alternating quantities- rectangular, polar and exponential forms. Analysis of simple ac circuits - concept of impedance. Power and power factor in ac circuits- active, reactive and apparent power. Solution of RL, RC and RLC circuits. Three phase systems: Generation of three phase voltages- advantages of three phase systems, star and delta connection, three wire and four wire systems, relation between line and phase voltages, line and phase currents. Three phase power measurement by two wattmeter method. Numerical problems.	9	15%
IV	Generation of power: Block schematic representation of generating stations-hydroelectric, thermal and nuclear power plants. Renewable energy sources. Power transmission and distribution: Typical electrical power transmission scheme, need for high voltage transmission, substation equipments, primary and secondary transmission and distribution systems.	5	15%
SECOND INTERNAL EXAM			
V	Transformers: construction of single phase and three phase transformers (core type only) – EMF equation, losses and efficiency. Electric Machines: D.C. Machines - Construction, types, principles of operation of dc motor, applications. AC Motors - Construction, principles of operation of single phase and three phase induction motor. Principle of operation of Universal motor.	7	20%
VI	Tariff: Different types of LT and HT consumers, tariff schemes - uniform tariff and differential tariff. Wiring systems: Basic concepts of wiring (conduit wiring only), service mains, meter board and distribution board. Earthing of installations - necessity of earthing, plate & pipe earthing, protective fuses, MCB, ELCB. Lamps: Different types of lamps - Incandescent lamps, fluorescent, mercury vapour, sodium vapour, metal halide and LED lamps.	6	20%
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EC100	BASICS OF ELECTRONICS ENGINEERING	2-1-0-3	2015

Course Objectives

1. To get basic idea about types, specification and common values of passive components.
2. To familiarize the working and characteristics of diodes, transistors, MOSFETS and some measuring instruments.
3. To understand working of diodes in circuits and in rectifiers.

Syllabus

Evolution and Impact of Electronics in industries and in society, Familiarization of Resistors, Capacitors, Inductors, Transformers and Electro mechanical components, PN Junction diode: Structure, Principle of operation, Photo diode, LED, Solar cell, Bipolar Junction Transistors: Structure, Principle of operation, characteristics, Rectifiers and power supplies: Half wave and full wave rectifier, capacitor filter, zener voltage regulator, Amplifiers and Oscillators: common emitter amplifier, feedback, oscillators, RC phase shift oscillator, Analogue Integrated circuits: operational amplifier, inverting and non-inverting amplifier, comparator, Electronic Instrumentation: digital multimeter, digital storage oscilloscope, function generator, Radio communication: principle of AM & FM, super heterodyne receiver, Radar system: Principle, block diagram of pulsed radar, Satellite communication: geo-stationary satellite, transponder, Global Positioning System, Mobile communication: cellular communications, cells, GSM, Optical communication: system, principle of light transmission through fiber, Entertainment Electronics: Color television, cable TV, CCTV system, HDTV, LCD & LED displays.

Expected outcome

Student can identify the active and passive electronic components. Student can setup simple circuits using diodes and transistors. Student will get fundamental idea about basic communication systems and entertainment electronics.

References Books:

- Bell, D. A., Electronic Devices and Circuits, Oxford University Press
- Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education
- Frenzel, L. E., Principles of Electronic Communication Systems, Mc Graw Hill
- Kennedy, G. and Davis, B., Electronic Communication Systems, Mc Graw Hill
- Tomasy, W., Advanced Electronic Communication system, PHI Publishers

Course Plan

Module	Contents	Hours	Sem. Marks
I	Evolution of Electronics, Impact of Electronics in industry and in society.	1	10%
	Resistors, Capacitors: types, specifications. Standard values, marking,	3	

	colour coding.		
	Inductors and Transformers: types, specifications, Principle of working.	2	
	Electro mechanical components: relays and contactors.	1	
II	PN Junction diode: Intrinsic and extrinsic semiconductors, Principle of operation, V-I characteristics, principle of working of Zener diode, Photo diode, LED and Solar cell.	3	20%
	Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, input and output characteristics of common emitter configuration, Typical specifications of low, medium and high power and frequency diodes and transistors, packaging.	4	
FIRST INTERNAL EXAM			
III	Rectifiers and power supplies: Block diagram description of a dc power supply ,Half wave and full wave (including bridge) rectifier, capacitor filter, working of simple zener voltage regulator, Principle of SMPS	4	15%
	Amplifiers and Oscillators: Circuit diagram and working of common emitter amplifier, Block diagram of Public Address system, concepts of feedback, working principles of oscillators, circuit diagram & working of RC phase shift oscillator.	3	
IV	Analogue Integrated circuits: Functional block diagram of operational amplifier, ideal operational amplifier, inverting and non inverting amplifier, comparator.	3	15%
	Digital ICs: Logic Gates.	1	
	Electronic Instrumentation: Principle and block diagram of digital multimeter, principle of digital storage oscilloscope, principle and block diagram of function generator.	3	
SECOND INTERNAL EXAM			
V	Radio communication: principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver.	3	20%
	Radar system: Principle, block diagram of pulsed radar.	1	
	Satellite communication: concept of geo-stationary satellite, satellite transponder, advantages, principle of Global Positioning System.	3	
VI	Mobile communication: basic principles of cellular communications, concepts of cells, frequency reuse, principle and block diagram of GSM.	2	20%
	Optical communication: block diagram of the optical communication system, principle of light transmission through fiber, advantages of optical communication systems.	2	
	Entertainment and Security Electronics Technology: Basic principles of cable TV, CCTV, DTH system, HDTV, Plasma, LCD, LED TV.	3	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
MA102	DIFFERENTIAL EQUATIONS	3-1-0-4	2015

Course Objectives

This course introduces basic ideas of differential equations, both ordinary and partial, which are widely used in the modeling and analysis of a wide range of physical phenomena and has got applications across all branches of engineering. The course also introduces Fourier series which is used by engineers to represent and analyze periodic functions in terms of their frequency components.

Syllabus

Homogeneous linear ordinary differential equations, non-homogeneous linear ordinary differential equations, numerical solutions of ordinary differential equations, Fourier series, partial differential equations, applications of partial differential equations.

Expected outcome

At the end of the course students will have acquired basic knowledge of differential equations and methods of solving them and their use in analyzing typical mechanical or electrical systems. The included set of assignments will familiarize the students with the use of software packages for analyzing systems modeled by differential equations.

Text Books:

- Kreyszig, E., Advanced Engineering Mathematics, Wiley
- Srivastava, A. C. and Srivasthava, P. K., Engineering Mathematics, Vol 2. PHI Learning Pvt. Ltd.

References Books:

- Bali, N. P. and Goyal, M., Engineering Mathematics, Lakshmy Publications
- Datta, Mathematical Methods for Science and Engineering. Cengage Learning
- Edwards, C. H. and Penney, D. E., Differential Equations and Boundary Value Problems. Computing and Modelling, Pearson.
- Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
- Jordan, D. W. and Smith, P., Mathematical Techniques, Oxford University Press
- Pal, S and Bhunia, S. C., Engineering Mathematics, Oxford, 2015
- Ross, S. L., Differential Equations, Wiley

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	HOMOGENEOUS LINEAR DIFFERENTIAL EQUATIONS (Text Book 1: Sections: 1.7, 2.1, 2.2,2.4,2.6, 3.1, 3.2) Existence and Uniqueness theorem for solutions of initial value problems (without proof). Basic theory of solutions of homogeneous differential equations (superposition principle, basis of solutions, general and	5	15%

	particular solutions).		
	Methods of solving homogeneous linear differential equations with constant coefficients of orders two or higher. Modelling of free oscillations of a mass-spring system. (For practice and submission as assignment only: Solutions of separable, exact and first order linear differential equations and orthogonal trajectories)	4	
II	NON-HOMOGENEOUS LINEAR ORDINARY DIFFERENTIAL EQUATIONS (Text Book 1: Sections: 2.7—2.10, 3.3) Basic theory of non-homogeneous linear differential equations. Methods of solving non-homogeneous linear differential equations with constant coefficients	4	
	Method of undetermined coefficients and method of variation of parameters.	4	15%
	Legendre and Cauchy's differential equations. Modelling of forced oscillations of mass-spring system and electric circuits. (For practice and submission as assignment only: Sketching, plotting and interpretation of solutions of differential equations using suitable software packages)	2	
FIRST INTERNAL EXAM			
III	NUMERICAL SOLUTIONS OF DIFFERENTIAL EQUATIONS (Text Book 1: sections 21.1, 21.2) Basic idea of numerical solutions of differential equations. Euler-method, improved Euler method, Runge-kutta method of fourth order (without proof)	6	
	Predictor-corrector method of Adams-Moulton (without proof). Error bounds of these methods. (For practice and submission as assignment only: Implementation of the above numerical methods in any programming language or using software packages)	2	15%

IV	FOURIER SERIES (Text Book 1: Sections: 11.1-11.2) Periodic Functions- Orthogonality of Sine and Cosine functions-Fourier series of periodic functions, Euler's formula, Condition for Convergence of Fourier series (without proof)	3	15%
	Fourier series for even and odd functions, Half range expansion (For practice and submission as assignment only: Plots of partial sums of Fourier series and demonstration of convergence using plotting software)	6	
SECOND INTERNAL EXAM			
V	PARTIAL DIFFERENTIAL EQUATION (Text Book 2: Section: 5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.1.9, 5.1.10, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 5.2.10) Formation of PDEs, solutions of first order PDEs, General integral, complete integral, Lagrange's linear equation,	5	20%
	Higher order PDE-Solution of Linear Homogeneous PDE with Constant Coefficients.	5	
VI	**A**PPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (Text Book 2: Section: 6.1, 6.2, 6.3, 6.4, 6.7, 6. 8, 6. 9, 6.9.1, 6.9.2) Method of Separation of Variables	2	20%
	Modelling Vibrations of a Stretched sting-One dimensional wave equation and its Solution by Fourier series.	4	
	Heat transfer through an insulated rod-one dimensional heat equation. Solution of heat equation by Fourier series in special cases– insulated rod with ends at zero temperatures, insulated rod with ends at non-zero temperatures. (For practice and submission as assignment only: Plots of partial sums of Fourier series solutions of PDEs and demonstration of convergence using plotting software)	4	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
BE102	**DESIGN AND ENGINEERING**	**2-0-2-3**	**2015**

Course Objectives

The purpose of this course is:-

1. To excite the student on creative design and its significance;
2. To make the student aware of the processes involved in design;
3. To make the student understand the interesting interaction of various segments of humanities, sciences and engineering in the evolution of a design;
4. To get an exposure as to how to engineer a design.

Syllabus

Design and its objectives; Role of science, engineering and technology in design; Engineering as a business proposition; Creative design and the Design Process; Design evaluation and communication of designs; Design for function and strength; Material selection and design detailing; Role of standards in design Engineering the design; Design for "X"; Product centered and user centered design; Aesthetics and ergonomics; Concepts of value engineering, concurrent engineering and reverse engineering in design; Culture based design; Modular design; Design optimization needs; User interface; Intelligent and autonomous products; Internet of things; Advanced products and human psychology; Life cycle design; Product and its environment; Design as a marketing tool; Products and IPR; Product liability.

Expected outcome

The student will be:-

1. Able to appreciate the different elements involved in good designs and to apply them in practice when called for.
2. Aware of the product oriented and user oriented aspects that make the design a success.
3. Will be capable to think of innovative designs incorporating different segments of knowledge gained in the course;
4. Students will have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.

References Books:

- Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN-13: 978-0124158917 ISBN-10: 0124158919
- Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction - Wiley, ISBN-978-1-118-32458-5
- Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer
- Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning, ISBN-13: 978-0-495-66816-9
- Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic

Approach, 3rd ed. 2007, XXI, 617p., ISBN 978-1-84628-319-2

- Voland, G., Engineering by Design, ISBN 978-93-325-3505-3, Pearson India

Web pages:

1. E-Book (Free download): http://opim.wharton.upenn.edu/~ulrich/designbook.html
2. http://www2.warwick.ac.uk/fac/sci/wmg/ftmsc/modules/modulelist/peuss/designforx/design_for_x_notes_section_5.pdf

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Design and its objectives; Design constraints, Design functions, Design means and Design from; Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. Design form, function and strength;	L2	15%
	How to initiate creative designs? Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey-customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.	L3	
	An Exercise in the process of design initiation. A simple problem is to be taken up to examine different solutions-Ceiling fan? Group Presentation and discussion.	P4	
II	Design process- Different stages in design and their significance; Defining the design space; Analogies and "thinking outside of the box"; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design.	L2	15%
	Design Communication; Realization of the concept into a configuration, drawing and model. Concept of "Complex is Simple". Design for function and strength. Design detailing- Material selection, Design visualisation- Solid modelling; Detailed 2D drawings; Tolerancing; Use of standard items in design; Research needs in design; Energy needs of the design, both in its realization and in the applications.	L3	
	An exercise in the detailed design of two products (Stapler/ door/clock)	P4	
FIRST INTERNAL EXAM			
III	Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis.	L2	15%
	Engineering the design – From prototype to product. Planning; Scheduling; Supply chains; inventory; handling;	L3	

	manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design.		
	List out the standards organizations. Prepare a list of standard items used in any engineering specialization. Develop any design with over 50% standard items as parts.	P4	
IV	Design for "X"; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. List out the design requirements(x) for designing a rocket shell of 3 meter diameter and 8 meter length.	L4	15%
	Design mineral water bottles that could be packed compactly for transportation.	P4	
SECOND INTERNAL EXAM			
V	Product centred and user centred design. Product centred attributes and user centred attributes. Bringing the two closer. Example: Smart phone. Aesthetics and ergonomics.	L2	
	Value engineering, Concurrent engineering, Reverse engineering in design; Culture based design; Architectural designs; Motifs and cultural background; Tradition and design; Study the evolution of Wet grinders; Printed motifs; Role of colours in design.	L4	20%
	Make sharp corners and change them to smooth curves-check the acceptance. Examine the possibility of value addition for an existing product.	P6	
VI	Modular design; Design optimization; Intelligent and autonomous products; User interfaces; communication between products; autonomous products; internet of things; human psychology and the advanced products. Design as a marketing tool; Intellectual Property rights – Trade secret; patent; copy-right; trademarks; product liability.	L3	20%
	Group presentation of any such products covering all aspects that could make or mar it.	P6	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P-Credits	Year of Introduction
PH110	ENGINEERING PHYSICS LAB	0-0-2-1	2015

Course Objectives

This course is designed (i) to impart practical knowledge about some of the phenomena they have studied in the Engineering Physics course and (ii) to develop the experimental skills of the students.

List of Exercises / Experiments (Minimum of 8 mandatory)

Basics

1. Study of application of Cathode Ray Oscilloscope (CRO) for Frequency and Amplitude measurements. Lissajeous figures (useful for different types of polarized light.)
2. Temperature measurement – Thermocouple
3. Measurement of strain using strain gauge and Wheatstones bridge.

Waves, Oscillations and Ultrasonics

4. Wave length and velocity measurement of ultrasonic waves in a liquid using ultrasonic diffractometer.
5. The LCR Circuit – Forced and damped harmonic oscillations.
6. Meldes string apparatus. Measurement of frequency in the transverse and longitudinal mode.

Interference

7. Wave length measurement of a monochromatic source of light using Newton's Rings method.
8. Determination of refractive index of a liquid using Newton's Rings apparatus.
9. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method.

Diffraction

10. To determine the slit or pinhole width.
11. To measure wavelength using a millimeter scale as a grating.
12. Determination the wavelength of He-Ne laser or any standard laser using diffraction grating.
13. To determine the wavelength of monochromatic light using grating.
14. Determination of dispersive power and resolving power of a plane transmission grating.

Polarisation

15. Kerr Effect - To demonstrate the Kerr effect in nitrobenzene solution and to measure the light intensity as a function of voltage across the Kerr cell using photo detector.
16. To measure the light intensity of plane polarised light as a function of the analyzer position.
17. Laurent's Half Shade Polarimeter -To observe the rotation of the plane of polarization of monochromatic light by sugar solution and hence to determine the concentration of solution of optically active substance.

Laser & Photonics

18. To determine the speed of light in air using laser.
19. Calculate the numerical aperture and study the losses that occur in optical fiber cable.
20. Determination of the particle size of lycopodium powder.
21. I-V characteristics of solar cell
22. To measure Planck's constant using photo electric cell.
23. Measurement of wavelength of laser using grating.

Reference Books:

- Avadhanulu, M. N., Dani, A. A. and Pokley, P. M., Experiments in Engineering Physics, S. Chand & Co.
- Gupta, S. K., Engineering Physics Practicals, Krishna Prakashan Pvt. Ltd.
- Koser, A. A., Practical Engineering Physics, Nakoda Publishers and Printers India Ltd
- Rao, B. S. and Krishna, K. V., Engineering Physics Practicals, Laxmi Publications
- Sasikumar, P. R. Practical Physics, PHI.

Website:

- http://www.indosawedu.com

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CY 110	ENGINEERING CHEMISTRY LAB	0-0-2-1	2015

List of Exercises / Experiments (Minimum of 8 mandatory)

1. Estimation of Total Hardness – EDTA method.
2. Estimation of Iron in Iron ore.
3. Estimation of Copper in Brass.
4. Estimation of dissolved oxygen by Winklers method.
5. Estimation of chloride in water.
6. Preparation of Urea formaldehyde and Phenol-formaldehyde resin.
7. Determination of Flash point and Fire point of oil by Pensky Martin Apparatus.
8. Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution.
9. Determination of molar absorptivity of a compound other than Fe^{3+}.
10. Analysis of IR spectra of any three organic compounds.
11. Analysis of ^{1}H NMR spectra of any three organic compounds.
12. Calibration of pH meter and determination of pH of a solution.
13. Verification of Nernst equation for electrochemical cell.
14. Potentiometric titrations: acid – base and redox titrations
15. Conductivity measurements of salt solutions.
16. Flame photometric estimation of Na+ to find out the salinity in sand.

Expected outcome

The student will be able to apply and demonstrate the theoretical concepts of Engineering Chemistry.

References:

- Practical Engineering Chemistry Lab Manual, Owl book publishers

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CE110	CIVIL ENGINEERING WORKSHOP	0-0-2-1	2015

List of Exercises / Experiments (Minimum of 8 mandatory)

(For Civil Engineering Branch)

Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape only.

Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape and cross staff.

Construct a wall of height 50 cm and wall thickness 1½ bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm.

Construct a wall of height 50 cm and wall thickness 2 bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm.

Compute the area and/or volume of various features of a building/structure such as door and window size, number of bricks required to construct a wall of a building, diameter of bars used in windows etc. – To create an awareness of measurements and units (use tape or other simple measuring instruments like vernier caliper, screw gauge etc.).

Testing of building materials: The student should do the compression testing of any three construction materials and compare the strength (brick, hollow block, laterite block, cement concrete cube, stone block, and so on).

Computation of Centre of gravity and Moment of inertia of a given rolled steel section by actual measurements.

Introduction to simple plumbing and sanitary fittings.

Home assignment 1: Preparation of a building model - The students in batches should prepare and submit a building model for a given plinth area in a given site plan constrained by a boundary wall. The minimum requirements of a residential building viz., drawing cum dining room, one bed room and a kitchen should be included. The concept of an energy efficient building should also be included in the model.

Home assignment 2: Report preparation -The student should collect the construction details of any one unique Civil Engineering structure, prepare and submit a detailed report with neat illustrations.

Home assignment 3: Report preparation - The students should collect samples of building materials, prepare and submit a detailed report including their market rates.

(For braches other than Civil Engineering)

Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape only.

Setting out of a building: The student should set out a building (single room only) as per the

given building plan using tape and cross staff. Building area computation: The student should prepare a rough sketch of a given single storeyed building and by taking linear measurements compute plinth area and carpet area of the given building. Construct a wall of at least a height of 500mm and wall thickness 1brick using English bond (No mortar required) - corner portion – length of side walls at least 600mm. Compute the area and/or volume of various features of a building/structure such as door and window size, number of bricks required to construct a wall of a building, diameter of bars used in windows etc. – To create an awareness of measurements and units (use tape or other simple measuring instruments like vernier calipers, screw gauge etc.). Horizontal measurements: Find the area of an irregular polygon set out on the field. Vertical measurements: Find the level difference between any two points. Computation of Centre of gravity and Moment of inertia of a given rolled steel section by sketching and measurements. Home assignment 1: Preparation of a building model - The students in batches should prepare and submit a building model for a given plinth area in a given site plan constrained by a boundary wall. The minimum requirements of a residential building viz., drawing cum dining room, one bed room and a kitchen should be included. The concept of an energy efficient building should also be included in the model. Home assignment 2: Report preparation - The student should collect the construction details of an industrial building related to their branch of study, prepare and submit a detailed report with neat illustrations. Home assignment 3: Report preparation - The students should collect samples of building materials, prepare and submit a detailed report about their market rates.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
ME110	MECHANICAL ENGINEERING WORKSHOP	0-0-2-1	2015

Course Objectives

Introduction to manufacturing processes and applications. Familiarization of various tools, measuring devices, practices and machines used in various workshop sections.

List of Exercises / Experiments (Minimum of 8 mandatory)

Sl. No.	Name of Shop floor	Exercises	No of sessions
1	General	Studies of mechanical tools, components and their applications: (a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc. And accessories (b) Components: Bearings, seals, O-rings, circlips, keys etc.	1
2	Carpentry	Any one model from the following: 1. T-Lap joint 2. Cross lap joint 3. Dovetail joint 4. Mortise joint	2
3	Smithy	(a) Demonstrating the forgability of different materials (MS, Al, Alloy steel and Cast steel) in cold and hot states. (b) Observing the qualitative differences in the hardness of these materials (c) Determining the shape and dimensional variations of Al test specimen due to forging under different states by visual inspection and measurements	2
4	Foundry	Any one exercise from the following 1. Bench moulding 2. Floor moulding 3. Core making	2
5	Sheet metal	Any one exercise from the following Making 1. Cylindrical 2. Conical 3. Prismatic shaped jobs from sheet metal	2
6	Welding	Any one exercise from the following Making joints using Electric arc welding. Bead formation in horizontal, vertical and overhead positions	2
7	Fitting and Assembly	Filing exercise and any one of the following exercises Disassembling and reassembling of 1. Cylinder piston assembly 2. Tail stock assembly 3. Time piece/clock 4. Bicycle or any machine.	2
8	Machines	Demonstration and applications of Drilling machine, Grinding machine, Shaping machine, Milling machine and lathe	2

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EE110	ELECTRICAL ENGINEERING WORKSHOP	0-0-2-1	2015

Course Objectives

The objective of this course is to familiarize the students with commonly used components, accessories and measuring equipment in Electrical installations. The course also provides hands on experience in setting up of simple wiring circuits.

List of Exercises / Experiments (Minimum of 8 mandatory)

1. Identify different types of cables/wires and switches and their uses.
2. Identify different types of fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.
3. Wiring of simple light circuit for controlling light/fan point (PVC conduit wiring).
4. Wiring of light/fan circuit using Two way switches (Staircase wiring)
5. Wiring of fluorescent lamps and light sockets (6 A)
6. Wiring of Power circuit for controlling power device (16A socket)
7. Godown wiring / Tunnel wiring
8. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, Main switch and Energy meter.
9. Measurement of voltage, current, resistance, inductance, and capacitance in a given RLC circuit using LCR meter and Multimeter.
10. Measurement of voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit.
11. Wiring of backup power supply including inverter, battery and load for domestic installations.
12. Demonstration and measurement of power consumption of electric iron, mixer grinder, single phase pump, exhaust fan, etc.

Expected outcome

1. Familiarity with supply arrangements and their limitations, knowledge of standard voltages and their tolerances, safety aspects of electrical systems and importance of protective measures in wiring systems.
2. Knowledge about the types of wires, cables and other accessories used in wiring. Creating awareness of energy conservation in electrical systems.
3. Students should be able to wire simple lighting circuits for domestic buildings, distinguish between light and power circuits.
4. To measure electrical circuit parameters and current, voltage and power in a circuit.
5. Familiarity with backup power supply in domestic installation.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
EC110	ELECTRONICS ENGINEERING WORKSHOP	0-0-2-1	2015

Course Objectives

This course gives the basic introduction of electronic hardware systems and provides hands-on training with familiarization, identification, testing, assembling, dismantling, fabrication and repairing such systems by making use of the various tools and instruments available in the Electronics Workshop.

List of Exercises / Experiments (Minimum of 8 mandatory)

1. Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)
2. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools, Interpret data sheets of discrete components and IC's, Estimation and costing.
3. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, CRO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station etc.]
4. Testing of electronic components [Resistor, Capacitor, Diode, Transistor, UJT and JFET using multimeter.]
5. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]
6. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]
7. Assembling of electronic circuit/system on general purpose PCB, test and show the functioning(**Any Four circuits)**
    1. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator.
    2. LED blinking circuit using a stable multi-vibrator with transistor BC 107.
    3. Square wave generation using IC 555 timer in IC base.
    4. Sine wave generation using IC 741 OP-AMP in IC base.
    5. RC coupled amplifier with transistor BC 107.
    6. AND and NAND gates in diode transistor logic.

8.Familiarization of electronic systems (**Any three systems)**

1. Setting up of a PA system with different microphones, loud speakers, mixer etc.
2. Assembling and dismantling of desktop computer/laptop/mobile phones.
3. Coil/Transformer winding.
4. Identify the subsystems of TV, DTH, CCTV, Cable TV, CRO, Function generator etc.
5. Screen printing and PCB pattern transfer
6. Soldering & de-soldering of SMD using hot air soldering station.
7. Introduction to robotics- Familiarization of components (motor, sensors, battery etc.) used in robotics and assembling of simple robotic configurations.

Expected outcome

Student can identify the active and passive electronic components. Student gets hands-on assembling, testing, assembling, dismantling, fabrication and repairing systems by making use of the various tools and instruments available in the Electronics Workshop.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CS110	COMPUTER SCIENCE WORKSHOP	0-0-2-1	2015

Course Objectives

1. To familiarize students with basic hardware and software tools
2. To implement algorithms studied in the course Introduction to Computing & Problem Solving.
3. To learn the implementation of control structures, Iterations and recursive functions, Lists, Tuples and Dictionaries.
4. To implement operations of files.
5. To implement a small micro project using Python

List of Exercises / Experiments (Minimum of 8 mandatory)

List of Exercises:

Introduction: Familiarization of hardware components of a desktop computer (motherboard, cards, memory, slots, power, cables etc.) Familiarization of Operating systems and various tools, particularly those for scientific computing, open source tools etc.

Programming exercises in Python based on the course Introduction To Computing and Problem Solving (BE 101-05). The exercises may include programs using the following concepts–

1. **Decision making, branching and looping**
    1. Variables , Expressions & Conditional statements
    2. Iteration statements (While , For etc.)
2. **Function & Function calls**
    1. Function calls, Math functions
    2. Parameters and arguments
    3. Adding new functions, Recursion
3. **Strings**
    1. String traversal
    2. String searching, Comparison
    3. Other important String methods
4. **Lists, Tuples and Dictionaries**
    1. Traversing List, List Operations

2. Creation of Dictionary and Operations
3. Lists and Tuples

5. **Files and Operations**
   1. Files - defining, opening/closing, operations
   2. Pickling

6. **Micro Project**: Students are expected to do a micro project by using Python, preferably related to the Web

Expected outcome

1. Students are able to identify common hardware components and their purpose
2. Students gain sufficient awareness about latest software tools.
3. Students are able to develop programs in Python for common problems of reasonable complexity.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CH110	CHEMICAL ENGINEERING WORKSHOP	0-0-2-1	2015

Course Objectives

To impart in students the basic knowledge in chemical engineering through simple experiments and demonstrations.

List of Exercises / Experiments (Minimum of 8 mandatory)

1. Preparation of soap
2. Determination of flash and fire point
3. Preparation of Biodiesel
4. Specific gravity measurement
5. Fabrication of FRP laminates/ Study of filtration equipments
6. Study of distillation column
7. Study of absorption column
8. Study of heat exchanger
9. Study of size reduction equipment
10. Preparation of Pigment

Expected outcome

Students will have a thorough understanding of the basic concepts that they learn in the theory paper “Introduction to Chemical Engineering”.