VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD
Autonomous institute, affiliated to JNTUH
Shamshabad - 501 218, Hyderabad, Telangana, India
www.vardhaman.org

CURRICULUM

For

Bachelor of Technology

Civil Engineering
Electrical and Electronics Engineering
Mechanical Engineering
Electronics and Communication Engineering
Computer Science and Engineering
Information Technology
CSE (Artificial Intelligence and Machine Learning)

Under

Choice Based Credit System (CBCS)

B. Tech. - Regular Four-Year Degree Program
(For batches admitted from the Academic Year 2020 - 2021)
&
B. Tech. - Lateral Entry Scheme
(For batches admitted from the Academic Year 2021 - 2022)

November 2020

First Year Curriculum Structure
B. Tech - Civil Engineering

Regulations: VCE-R20

I Year I Semester

Induction Program for Two Weeks (Phase – I)

Course Code	Title of Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6001	Linear Algebra and Ordinary Differential Equations	BS	3	0	2	4	30	70	100
A6004	Engineering Physics	BS	3	0	2	4	30	70	100
A6009	English for Communication	HS	2	0	2	3	30	70	100
A6501	Problem Solving with Python	ES	2	0	2	3	30	70	100
A6301	Engineering Graphics	ES	1	0	4	3	30	70	100
A6302	Engineering Workshop	ES	0	0	2	1	30	70	100
A6021	Social Innovation	ES	0	0	2	1	30	70	100
Total			11	0	16	19	210	490	700

I Year II Semester

Induction Program for One Week (Phase – II)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6002	Numerical Methods and Calculus	BS	3	0	2	4	30	70	100
A6007	Engineering Chemistry	BS	3	0	2	4	30	70	100
A6010	Business English	HS	1	0	2	2	30	70	100
A6502	Data Structures	ES	3	0	2	4	30	70	100
A6303	Engineering Mechanics	ES	3	0	2	4	30	70	100
A6022	Engineering Exploration	ES	0	0	2	1	30	70	100
Total			13	0	12	19	180	420	600

First Year Curriculum Structure

B. Tech – Electrical and Electronics Engineering

Regulations: VCE-R20

I Year I Semester

Induction Program for Two Weeks (Phase – I)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6001	Linear Algebra and Ordinary Differential Equations	BS	3	0	2	4	30	70	100
A6005	Semiconductor Physics	BS	3	0	2	4	30	70	100
A6009	English for Communication	HS	2	0	2	3	30	70	100
A6501	Problem Solving with Python	ES	2	0	2	3	30	70	100
A6301	Engineering Graphics	ES	1	0	4	3	30	70	100
A6302	Engineering Workshop	ES	0	0	2	1	30	70	100
A6021	Social Innovation	ES	0	0	2	1	30	70	100
Total			11	0	16	19	210	490	700

I Year II Semester

Induction Program for One Week (Phase – II)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6002	Numerical Methods and Calculus	BS	3	0	2	4	30	70	100
A6008	Advanced Engineering Chemistry	BS	3	0	2	4	30	70	100
A6010	Business English	HS	1	0	2	2	30	70	100
A6502	Data Structures	ES	3	0	2	4	30	70	100
A6202	Circuit Theory	ES	3	0	2	4	30	70	100
A6022	Engineering Exploration	ES	0	0	2	1	30	70	100
Total			13	0	12	19	180	420	600

First Year Curriculum Structure
B. Tech – Mechanical Engineering

Regulations: VCE-R20

I Year I Semester

Induction Program for Two Weeks (Phase – I)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6001	Linear Algebra and Ordinary Differential Equations	BS	3	0	2	4	30	70	100
A6004	Engineering Physics	BS	3	0	2	4	30	70	100
A6009	English for Communication	HS	2	0	2	3	30	70	100
A6501	Problem Solving with Python	ES	2	0	2	3	30	70	100
A6301	Engineering Graphics	ES	1	0	4	3	30	70	100
A6302	Engineering Workshop	ES	0	0	2	1	30	70	100
A6021	Social Innovation	ES	0	0	2	1	30	70	100
Total			11	0	16	19	210	490	700

I Year II Semester

Induction Program for One Week (Phase – II)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6002	Numerical Methods and Calculus	BS	3	0	2	4	30	70	100
A6007	Engineering Chemistry	BS	3	0	2	4	30	70	100
A6010	Business English	HS	1	0	2	2	30	70	100
A6502	Data Structures	ES	3	0	2	4	30	70	100
A6303	Engineering Mechanics	ES	3	0	2	4	30	70	100
A6022	Engineering Exploration	ES	0	0	2	1	30	70	100
Total			13	0	12	19	180	420	600

First Year Curriculum Structure
B. Tech – Electronics and Communication Engineering

Regulations: VCE-R20

I Year I Semester

Induction Program for Two Weeks (Phase – I)

Course Code	Title of the Course	Category	Periods Per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6001	Linear Algebra and Ordinary Differential Equations	BS	3	0	2	4	30	70	100
A6005	Semiconductor Physics	BS	3	0	2	4	30	70	100
A6009	English for Communication	HS	2	0	2	3	30	70	100
A6501	Problem Solving with Python	ES	2	0	2	3	30	70	100
A6301	Engineering Graphics	ES	1	0	4	3	30	70	100
A6302	Engineering Workshop	ES	0	0	2	1	30	70	100
A6021	Social Innovation	ES	0	0	2	1	30	70	100
Total			11	0	16	19	210	490	700

I Year II Semester

Induction Program for One Week (Phase – II)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6002	Numerical Methods and Calculus	BS	3	0	2	4	30	70	100
A6008	Advanced Engineering Chemistry	BS	3	0	2	4	30	70	100
A6010	Business English	HS	1	0	2	2	30	70	100
A6502	Data Structures	ES	3	0	2	4	30	70	100
A6202	Circuit Theory	ES	3	0	2	4	30	70	100
A6022	Engineering Exploration	ES	0	0	2	1	30	70	100
Total			13	0	12	19	180	420	600

First Year Curriculum Structure
B. Tech – Computer Science and Engineering

Regulations: VCE-R20

I Year I Semester									
Induction Program for Two Weeks (Phase – I)									
Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6001	Linear Algebra and Ordinary Differential Equations	BS	3	0	2	4	30	70	100
A6006	Applied Chemistry	BS	3	0	2	4	30	70	100
A6009	English for Communication	HS	2	0	2	3	30	70	100
A6501	Problem Solving with Python	ES	2	0	2	3	30	70	100
A6201	Basic Electrical Engineering	ES	3	0	2	4	30	70	100
A6021	Social Innovation	ES	0	0	2	1	30	70	100
Total			13	0	12	19	180	420	600

I Year II Semester									
Induction Program for One Week (Phase – II)									
Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6002	Numerical Methods and Calculus	BS	3	0	2	4	30	70	100
A6003	Applied Physics	BS	3	0	2	4	30	70	100
A6010	Business English	HS	1	0	2	2	30	70	100
A6502	Data Structures	ES	3	0	2	4	30	70	100
A6301	Engineering Graphics	ES	1	0	4	3	30	70	100
A6302	Engineering Workshop	ES	0	0	2	1	30	70	100
A6022	Engineering Exploration	ES	0	0	2	1	30	70	100
Total			11	0	16	19	210	490	700

First Year Curriculum Structure
B. Tech – Information Technology

Regulations: VCE-R20

I Year I Semester

Induction Program for Two Weeks (Phase – I)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6001	Linear Algebra and Ordinary Differential Equations	BS	3	0	2	4	30	70	100
A6006	Applied Chemistry	BS	3	0	2	4	30	70	100
A6009	English for Communication	HS	2	0	2	3	30	70	100
A6501	Problem Solving with Python	ES	2	0	2	3	30	70	100
A6201	Basic Electrical Engineering	ES	3	0	2	4	30	70	100
A6021	Social Innovation	ES	0	0	2	1	30	70	100
Total			13	0	12	19	180	420	600

I Year II Semester

Induction Program for One Week (Phase – II)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6002	Numerical Methods and Calculus	BS	3	0	2	4	30	70	100
A6003	Applied Physics	BS	3	0	2	4	30	70	100
A6010	Business English	HS	1	0	2	2	30	70	100
A6502	Data Structures	ES	3	0	2	4	30	70	100
A6301	Engineering Graphics	ES	1	0	4	3	30	70	100
A6302	Engineering Workshop	ES	0	0	2	1	30	70	100
A6022	Engineering Exploration	ES	0	0	2	1	30	70	100
Total			11	0	16	19	210	490	700

First Year Curriculum Structure
B. Tech – Computer Science and Engineering (Artificial Intelligence and Machine Learning)

Regulations: VCE-R20

I Year I Semester

Induction Program for Two Weeks (Phase – I)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6001	Linear Algebra and Ordinary Differential Equations	BS	3	0	2	4	30	70	100
A6006	Applied Chemistry	BS	3	0	2	4	30	70	100
A6009	English for Communication	HS	2	0	2	3	30	70	100
A6501	Problem Solving with Python	ES	2	0	2	3	30	70	100
A6201	Basic Electrical Engineering	ES	3	0	2	4	30	70	100
A6021	Social Innovation	ES	0	0	2	1	30	70	100
Total			13	0	12	19	180	420	600

I Year II Semester

Induction Program for One Week (Phase – II)

Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		CIE	SEE	Total
A6002	Numerical Methods and Calculus	BS	3	0	2	4	30	70	100
A6003	Applied Physics	BS	3	0	2	4	30	70	100
A6010	Business English	HS	1	0	2	2	30	70	100
A6502	Data Structures	ES	3	0	2	4	30	70	100
A6301	Engineering Graphics	ES	1	0	4	3	30	70	100
A6302	Engineering Workshop	ES	0	0	2	1	30	70	100
A6022	Engineering Exploration	ES	0	0	2	1	30	70	100
Total			11	0	16	19	210	490	700

Course Structure
A6001 - Linear Algebra and Ordinary Differential Equations

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. In this course, the students are acquainted with the solution of system of linear equations, eigen values and eigen vectors, ordinary differential equations of first and higher order and Laplace transforms. In addition, this course can be applied in many areas of engineering such as computer graphics, cryptography, wireless communication, signal processing, robotics, and animation.

Course Pre/co-requisites

This course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6001.1. Solve system of linear equations using rank of a matrix.
A6001.2. Examine the nature of quadratic form using eigen values and eigen vectors.
A6001.3. Solve ordinary differential equations first and higher order.
A6001.4. Make use of ordinary differential equations to solve engineering problems.
A6001.5. Apply Laplace transforms to solve ordinary differential equations.

3. Course Syllabus

Theory

Theory of Matrices: Real, complex matrices and their properties, Rank of a matrix by reducing to echelon form and normal form, Consistency of system of linear equations using the rank of a matrix.

Eigen Values and Eigen Vectors: Linear transformation, Eigen values and Eigen vectors of a matrix, Cayley-Hamilton theorem, Diagonalization. Rank, index, signature, and nature of quadratic forms up to three variables, Reduction of quadratic form to canonical form by
an orthogonal transformation.

Ordinary Differential Equations of First Order: Exact equations and equations reducible to exact form using integrating factors, Linear differential equations, and Bernoulli's equations, Newton's law of cooling, Law of natural growth and decay.

Linear differential equations of second and higher order: Higher order linear homogeneous and non-homogeneous linear differential equations, Equations reducible to linear equations
with constant coefficients: Cauchy's homogeneous linear equations, Method of variation of parameters, $L-C-R$ circuits, Simple harmonic motion and Bending of beams.

Laplace Transforms: General properties of Laplace transforms, Laplace transform of periodic function, Inverse Laplace transforms, General properties of Inverse Laplace transforms, Convolution theorem, Application of Laplace transform to ordinary differential equations with constant coefficients.

Practice

1. Study of Basic Scilab Commands
2. Matrix Constructors and Operations
3. Matrix Bitwise, Relational & Logical Operations
4. Solution of System of non-homogeneous Linear Equations
5. Solution of System of homogeneous Linear Equations
6. Find Eigen values and Eigenvectors of a matrix
7. Find Rank, index, signature, and nature of quadratic forms
8. Create x-y plots and contour plots in 2D graphs
9. Plotting 3D graphs
10. Solution of ordinary differential equations of first order
11. Solution of growth and decay
12. Solution of ordinary differential equations of higher order.
13. Solution of Simple harmonic motion, L-C-R circuits, Bending of Beams.
14. Laplace Transform of Elementary functions.

4. Laboratory Equipment/Software/Tools Required

1. PCs installed with operating system.
2. Scilab: Open-source software for numerical computation.

5. Books and Materials

Text Books:

1. Grewal,B.S. *Higher Engineering Mathematics*, 43rd Edition, Khanna Publications, 2015.
2. Jain, R.K. and Iyengar, S.R.K. *Advanced Engineering Mathematics*, 3rd Edition, Narosa Publishing House, 2011.

Reference Books:

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons,2006.
2. Ramana, B.V. *Higher Engineering Mathematics*, 32ndReprint, McGraw Hill Education (India) Pvt Ltd,2018.

Course Structure
A6002 - Numerical Methods and Calculus

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

This course provides mathematical knowledge required to analyze problems encountered in engineering. The course covers numerical methods to evaluate roots of algebraic and transcendental equations, find missing data values by interpolating, and perform numerical differentiation and integration, evaluate partial differential equations of first order, functions of several variables and vector Calculus. The mathematical skills derived from this course provides necessary base to analytical and theoretical concepts occurring in the program.

Course Pre/co-requisites

This course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6002.1. Apply appropriate Numerical method to find a root of an equation and interpolate to approximate the values of the function at intermediate points.
A6002.2. Evaluate definite integrals using appropriate methods.
A6002.3. Solve partial differential equations of first order.
A6002.4. Examine the extremum of a function of several variables.
A6002.5. Make use of vector integral theorems to evaluate area, surface area and volumes.

3. Course Syllabus

Theory

Solution of Algebraic and Transcendental Equations: Bisection method, Regula-Falsi method, Fixed point iteration method and Newton-Raphson method. **Interpolation:** Finite differences, other operators, Newton's forward and backward difference interpolation formulae, Lagrange's interpolation formula.

Numerical Differentiation and Integration: Derivatives using Newton's forward and backward interpolation formulae, Newton-Cotes quadrature formula - Trapezoidal rule, Simpson's one-third rule and Simpson's three-eighth rule. **Numerical Solution of Ordinary Differential Equations:** Single step methods: Euler's Method, fourth order Runge-Kutta method for solving first order equations.

Multivariable Calculus: Jacobians, functional dependence, maxima, and minima of functions of two variables, double integrals, change of order of integration and change of variables in double integrals, evaluation of triple integrals.

Partial Differential Equations of First Order: Formation of partial differential equation by eliminating the arbitrary constants and arbitrary functions, solutions of first order linear, quasi linear (Lagrange) equations and nonlinear (standard type) equations, equations reducible to standard form.

Vector Calculus: Scalar and vector point functions, gradient, directional derivative, divergence, curl and their related properties, scalar potential function, Line integral, work done, surface integrals, volume integrals, Evaluation of integral theorems - Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem (without proof).

Practice

1. Solve non-linear equation using Bisection Method.
2. Solve non-linear equation using Regula falsi method.
3. Solve non-linear equation using Iteration Method.
4. Solve non-linear equation using Newton Raphson Method.
5. Determine Newton's Forward interpolation polynomial.
6. Compute Newton's backward interpolation to polynomial.
7. Lagrange's Interpolation to find new data points for unequally spaced values.
8. Solve definite integral using Trapezoidal Rule.
9. Solve definite integral using Simpson's $1/3^{rd}$ Rule.
10. Solve definite integral using Simpson's $3/8^{th}$ Rule.
11. Solve initial value problem using Eulers method.
12. Solve initial value problem using Runge-Kutta method
13. Double Integration in rectangular domain.
14. Find dot product, cross product and angle between vectors using vector operators.

4. Laboratory Equipment/Software/Tools Required

1. PCs installed with Operating System.
2. Scilab: Open-source software for numerical computation.

5. Books and Materials

Text Book (s)

3. Grewal,B.S. *Higher Engineering Mathematics*, 43^{rd} Edition, Khanna Publications, 2015.
4. Jain, R.K. and Iyengar, S.R.K. *Advanced Engineering Mathematics*, 3^{rd} Edition, Narosa Publishing House, 2011.

Reference Book(s)

2. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9^{th}Edition, John Wiley & Sons,892006.
3. Ramana, B.V. *Higher Engineering Mathematics*, 32^{nd} Reprint, McGraw Hill Education (India) Pvt Ltd,2018.

Course Structure
A6003 - Applied Physics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

Applied Physics course is an integrated course, which introduces fundamental Physics with applications to semiconductors and other electronic devices, focusing on the principles of their operation. A part of the course is focused on current transport across semiconductor junctions. This interdisciplinary knowledge which includes lasers, wave optics, optical fibres and nanomaterials encourages an understanding of technological applications of Physics and its importance as a subject of social and industrial relevance enabling the students to design and innovate. This course demonstrates various semiconductor materials behaviour through experiments.

Course Pre/co-requisites

This course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6003.1. Classify materials based on their crystal structures.

A6003.2. Utilize quantum mechanics to interpret the properties of semiconducting materials.

A6003.3. Develop communication systems by means of lasers and optical fibres.

A6003.4. Analyze the principles of nanotechnology for electronic applications.

A6003.5. Categorize magnetic materials and apply it to explain superconductivity.

3. Course Syllabus

Theory

Quantum Computing and Crystal structures: Introduction, Photo Electric Effect, de-Broglie hypothesis, dual nature of matter, Concept of Wave function, Time independent Schrödinger Wave equation, Introduction to Number system, Binary system, Bits and Qubits, Classical gates Vs Quantum gates, Space lattice, Basis, Lattice parameters, Unit Cell, lattice constant of cubic structure, Co-ordination number, packing factor of SCC, BCC, FCC and diamond, Crystal structures of Silicon(diamond), ZnS.

Semiconductors and Semiconducting Devices: Types of electronic materials: Metals, semiconductors and insulators based on Band theory of solids, Density of states, Classification of semiconductors, Fermi-Dirac distribution function, Carrier concentration in Intrinsic semiconductor, Position of Fermi level in Intrinsic and Extrinsic Semiconductors (Qualitative), Hall Effect, Working principle and V-I Characteristics of P-N junction diode, LED and Solar Cell.

Lasers and Optical fibres: Absorption, spontaneous and Stimulated emission, Einstein's coefficients, population inversion, pumping processes, three and four level laser systems, Nd:YAG Laser, He-Ne laser, Semiconductor laser(homojunction), Applications of lasers, Introduction to Optical fibres, Total internal reflection, Acceptance angle, Numerical aperture, Step Index and Graded Index Optical fibers, Losses in optical fibres, Optical fibers in Communication System, Applications of Optical fibers.

Nanoscience: Characteristics and Types (1-D, 2-D, 3-D) of nano-materials, surface area to volume ratio (S/V ratio), Quantum Confinement, Top down (Ball Milling) and Bottom up (Sol-Gel - chemical Synthesis, Physical Vapour Deposition method), Graphene, CNT, Quantum Dots and applications of nanomaterials.

Magnetic and Superconducting Materials: Classification of magnetic materials (Dia, para, Ferro, Ferri, Anti Ferro materials (Qualitative), Weiss theory of ferromagnetism, hysteresis curve, Soft and Hard magnetic materials, Superconductivity and Meissner effect, Types of Superconductors, BCS Theory, High Temperature Superconductors, and their applications.

Practice

1. Determination of the value of Planck's constant 'h' and work function (w) by using Photocell.
2. Determination of the energy gap of a given semiconductor.
3. Study the V-I characteristics of PN junction diode under Forward & Reverse bias conditions.
4. Verification of the type of semi-conductor material and estimate the density of majority carriers by using Hall-Effect.
5. Determination of threshold voltage and study the V-I characteristics of LED.
6. Analyze V-I Characteristics of the solar cell to evaluate quality factor.
7. Evaluate the frequency (n) of an AC supply using Sonometer.
8. Determination of the wavelength of a given source of Laser light and identification of the number of lines on plane transmission grating.
9. Evaluation of the numerical aperture (NA) and acceptance angle (θ_A) of a given optical fiber.
10. Estimation of the bending loss in a given optical fiber and the transmission or propagation loss in a given optical fiber.

4. Laboratory Equipment/Software/Tools Required

1. Photo Emissive Cell
2. Regulated power supply (DC and AC)
3. Hall Effect Setup
4. Light Emitting Diode Kit
5. Solar cell Kit
6. Sonometer Setup
7. Semiconductor Laser Source
8. Plane diffraction grating
9. Optical fiber trainer kit
10. Meters - Ammeter, Voltmeter, Digital Multimeter
11. Diodes, Resistors, Capacitors, Bread Board

5. Books and Materials

Text Book(s)

1. Pandey, B. K. and Chaturvedi, S. (2014), *Engineering Physics*, New Delhi: Cengage Learning India Pvt. Ltd.

Reference Book(s)

1. Charles Kittel, (2014), *Introduction to Solid State Physics*, John Wiley & Sons.
2. Palanisamy, P.K. (2014), *Engineering Physics*, Scitech.
3. David Halliday, Jearl Walker, Robert Resnick, David G. Rethwisch, William D. Callister(2016), *Engineering Physics*, John Wiley & Sons.
4. Gaur R.K and Gupta S.L, (2012), *Engineering Physics*, Dhanpat Rai Publications.

Course Structure

A6004 - Engineering Physics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

Engineering Physics prepares students to apply physics to tackle engineering challenges. In this course, fundamental physics is combined with problem solving and engineering skills, which then has broad applications. This course provides the background that most engineering fields require. The syllabus is designed to provide a broad foundation as well as interdisciplinary knowledge for continuous innovation occurring with technology.

Course Pre/co-requisites

This course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6004.1. Classify materials based on their crystal structures.

A6004.2. Utilize quantum mechanics to interpret the properties of semiconducting materials.

A6004.3. Apply wave property of light to study different optical phenomenon.

A6004.4. Develop communication systems by means of lasers and optical fibers.

A6004.5. Analyze the principles of nanotechnology for electronic applications.

3. Course Syllabus

Theory

Quantum Computing and Crystal structures: Introduction, Photo Electric Effect, de-Broglie hypothesis, dual nature of matter, Concept of Wave function, Time independent Schrodinger Wave equation, Introduction to Number system, Binary system, Bits and Qubits, Classical gates Vs Quantum gates. Space lattice, Basis, Lattice parameters, Unit Cell, Crystalline and amorphous materials, Lattice parameters, lattice constant of cubic structure, Co-ordination number, packing factor of SCC, BCC, FCC and diamond, Crystal structures of Silicon(diamond), ZnS.

Semiconductors and Semiconducting Devices: Types of electronic materials: Metals, semiconductors, and insulators based on Band theory of solids, Density of states, Fermi-Dirac distribution function, Carrier concentration in Intrinsic semiconductor, Position of Fermi level in Intrinsic and Extrinsic Semiconductors(Qualitative), Hall Effect, Working principle and V-I Characteristics of P-N junction diode and LED.

Lasers and Optical fibres: Absorption, spontaneous and Stimulated emission, Einstein's coefficients, population inversion, pumping processes, three and four level laser systems, Nd:YAG Laser, He-Ne laser, Semiconductor laser(homojunction), Applications of lasers, Introduction to Optical fibres, Total internal reflection, Acceptance angle, Numerical aperture, Step Index and Graded Index Optical fibers, Losses in optical fibres, Optical fibres in Communication System.

Nanoscience: Characteristics and Types (1-D, 2-D, 3-D) of nanomaterials, surface area to volume ratio (S/V ratio), Quantum Confinement, Top down (Ball Milling) and Bottom up (Sol-Gel - chemical Synthesis, Physical Vapour Deposition method), Graphene, CNT, Quantum Dots and applications of nanomaterials.

Wave optics: Waves and wave fronts, Huygens' Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Constructive and destructive interference, Newton's rings, Types of diffraction, Fraunhofer and Fresnel diffraction, diffraction grating and their resolving power(qualitative).

Practice

1. Determination of the value of Planck's constant 'h' and work function (w) by using Photocell.
2. Determination of the energy gap of a given semiconductor.
3. Study the V-I characteristics of PN junction diode under Forward & Reverse bias conditions.
4. Verification of the type of semi-conductor material and estimation of the density of majority carriers by using Hall-Effect.
5. Determination of threshold voltage and study the V-I characteristics of LED.
6. Determination of the wavelength of Sodium light by Newton's rings method.
7. Identification of the number of lines on plane transmission grating and measurement of wavelengths of spectral lines of a Mercury (Hg) source using diffraction grating and a spectrometer.
8. Determination of the wavelength of a given source of Laser light and to identify the number of lines on plane transmission grating.
9. Evaluation of the numerical aperture (NA) and acceptance angle (θ_A) of a given optical fiber.
10. Estimation of the bending loss in a given optical fiber and transmission or propagation loss in a given optical fibre.

4. Laboratory Equipment/Software/Tools Required

1. Photo Emissive Cell
2. Regulated Power Supply (DC and AC)
3. Hall Effect Setup
4. Light Emitting Diode Kit
5. Newton's Ring Set up
6. Spectrometer
7. Sodium & Mercury Vapour Lamp
8. Semiconductor Laser Source
9. Plane diffraction grating
10. Optical Fiber trainer kit
11. Meters - Ammeter, Voltmeter, Digital Multimeter
12. Diodes, Resistors, Capacitors, Bread Board

5. Books and Materials

Text Book(s)

1. Pandey, B. K. and Chaturvedi, S. (2014), *Engineering Physics*, New Delhi: Cengage Learning India Pvt. Ltd.

Reference Book(s)

1. AjoyGhatak, (2012), *Optics,* McGraw Hill India.
2. Palanisamy, P.K. (2014), *Engineering Physics*, Scitech.
3. David Halliday, Jearl Walker, Robert Resnick, David G. Rethwisch, William D. Callister, (2016), *Engineering Physics*, John Wiley & Sons.
4. Gaur R.K and Gupta S.L, (2012), *Engineering Physics*, Dhanpat Rai Publications.

Course Structure
A6005 – Semiconductor Physics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

Semiconductor Physics course introduces fundamental physics with applications to semiconductors and other electronic devices with a focus on the principles of their operation. A part of the course is focused on current transport across semiconductor junctions. This interdisciplinary knowledge which includes lasers, optical fibres, and nanomaterials, encourages an understanding of technological applications of physics and its importance as a subject of social and industrial relevance enabling the students to design and innovate. This course demonstrates various semiconductor materials behaviour through experiments.

Course Pre/co-requisites

This course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6005.1. Classify materials based on their crystal structures.

A6005.2. Analyze the principles of quantum mechanics and nanotechnology for electronic applications.

A6005.3. Analyze the charge carrier dynamics and transport properties in semiconductors.

A6005.4. Develop communication systems by means of lasers and optical fibers.

A6005.5. Categorize dielectric materials and objectivize their role in superconductors.

3. Course Syllabus

Theory

Quantum Computing and Crystal structures: Introduction, Photo Electric Effect, de-Broglie hypothesis, dual nature of matter, Concept of Wave function, Time independent Schrödinger Wave equation, Introduction to Number system, Binary system, Bits and Qubits, Classical gates Vs Quantum gates, Space lattice, Basis, Lattice parameters, Unit Cell, lattice constant of cubic structure, Co-ordination number, packing factor of SCC, BCC, FCC and diamond, Crystal structures of Silicon(diamond), ZnS.

Semiconductors and Semiconducting Devices: Types of electronic materials: Metals, semiconductors, and insulators based on Band theory of solids, Density of states, Classification of semiconductors, Fermi-Dirac distribution function, Carrier concentration in Intrinsic semiconductor, Position of Fermi level in Intrinsic and Extrinsic Semiconductors(Qualitative), Hall Effect, Working principle and V-I Characteristics of P-N junction diode and Zener diode, LED and Solar Cell.

Lasers and Optical fibres: Absorption, spontaneous and Stimulated emission, Einstein's coefficients, population inversion, pumping processes, three and four level laser systems, Nd:YAG Laser, He-Ne laser, Semiconductor laser(homojunction), Applications of lasers, Introduction to Optical fibres, Total internal reflection, Acceptance angle, Numerical aperture, Step Index and Graded Index Optical fibers, Losses in optical fibres, Optical fibers in Communication System.

Nanoscience: Characteristics and Types (1-D, 2-D, 3-D) of nano-materials, surface area to volume ratio(S/V ratio), Quantum Confinement, Top down (Ball Milling) and Bottom up (Sol-Gel - chemical Synthesis, Physical Vapour Deposition method), Graphene, CNT, Quantum Dots and applications of nanomaterials.

Dielectrics and Superconductors: Electric dipole moment, dielectric constant, Types of polarization (qualitative), Concept of Local Field, Clausius – Mossotti Equation, Piezoelectricity and Ferroelectricity and their applications. Diamagnetism, Superconductivity and Meissner effect, Types of Superconductors, BCS Theory, High Temperature Superconductors, and their applications.

Practice

1. Determination of the value of Planck's constant 'h' and work function (w) by using Photocell.
2. Determination of the energy gap of a given semiconductor.
3. Study the V-I characteristics of PN junction diode under Forward & Reverse bias conditions.
4. Verification of the type of semi-conductor material and estimate the density of majority carriers by using Hall-Effect.
5. Determination of threshold voltage and study the V-I characteristics of LED.
6. Analyze V-I Characteristics of the solar cell to evaluate quality factor.
7. Study of exponential decay of charge in a R-C. Circuit and determination of time constant of R-C circuit.
8. Determination of the wavelength of a given source of Laser light and to identify the number of lines on plane transmission grating.
9. Evaluation of the numerical aperture (NA) and acceptance angle (θ_A) of a given optical fibre.
10. Estimation of the bending loss in a given optical fibre and the transmission or propagation loss in a given optical fibre.

4. Laboratory Equipment/Software/Tools Required

1. Photo Emissive Cell
2. Regulated Power Supply (DC and AC)
3. Hall Effect Setup
4. Light Emitting Diode Kit
5. Solar Cell Kit
6. Semiconductor Laser Source
7. Plane Diffraction Grating
8. Optical Fiber Trainer Kit
9. Meters - Ammeter, Voltmeter, Digital Multimeter
10. Diodes, Resistors, Capacitors, Bread Board

5. Books and Materials

Text Book(s)

1. Pandey, B. K. and Chaturvedi, S. (2014), *Engineering Physics*, New Delhi: Cengage Learning India Pvt. Ltd.

Reference Book(s)

1. Charles Kittel, (2004), *Introduction to Solid State Physics*, John Wiley & Sons.
2. Palanisamy, P.K. (2014), *Engineering Physics*, Scitech.
3. David Halliday, Jearl Walker, Robert Resnick, David G. Rethwisch, William D. Callister, (2016), *Engineering Physics*,John Wiley & Sons.
4. Gaur R.K and Gupta S.L, (2012), *Engineering Physics*, Dhanpat Rai Publications.

Course Structure
A6006 - Applied Chemistry

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

This course develops a strong foundation in physical and general chemistry to spread over an orientation towards the molecules, general properties of materials and various instrumental techniques. In addition, this course also focuses on fundamental principles of chemistry, potential applications, and practical utility to understand engineering problems.

Course Pre/co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6006.1. Identify differences and similarities of the Batteries.

A6006.2. List the applications of Rotaxanes and Catenanes as artificial molecular machines.

A6006.3. Illustrate the molecular orbital energy level diagram of different molecular species.

A6006.4. Make use of analytical instruments to measure physical and chemical properties of chemical compounds.

A6006.5. Analyze the impurities present in the water for industrial and domestic applications.

3. Course Syllabus

Theory

Electrochemistry and Batteries: Electrochemistry: Introduction, Electrode– electrode potential, standard electrode potential, types of electrodes– Construction and functioning of Standard hydrogen, Calomel and Quinhydrone electrodes. Engineering Applications: Batteries: Cell and battery – Primary battery (dry cell) and Secondary battery (Lithium-ion cell, lead acid battery, Nickel–Cadmium battery). Fuel cells: Hydrogen–Oxygen fuel cell – Applications.

Molecular Machines and Molecular Switches: Concepts and terms of supra molecular chemistry, complementarity, Basic Lock and Key principle, examples of Supramolecules. Molecular recognition- cation binding, anion binding, simultaneous cation and anion binding, supramolecular reactivity, and catalysis. Self-assembly in biological systems, Synthetic systems- catenanes, rotaxanes, metal ion assisted assemblies, template synthesis of macrocyclic ligands. Applications of Supramolecular Devices- Ionic devices, Electronic devices, Switching devices and artificial machines.

Structure and Bonding Models: Molecular orbital theory – bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of N_2, O_2 and CO. Calculation of bond order. Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry, magnetic and colour properties.

Instrumental Methods and Applications: Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. Principle, working and applications of pH metry, potentiometry, conductometry, UV-Visible, IR and NMR Spectroscopies. Principles and applications of Gas Chromatography (GC) and High-Performance Liquid Chromatography (HPLC), separation of gaseous mixtures and liquid mixtures.

Water treatment: Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness. Numerical problems. Boiler troubles: Sludges, scales, and Caustic embrittlement. Internal treatment of boiler feed water – Calgon conditioning – Phosphate conditioning – Colloidal conditioning – Industrial water treatment – specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards. Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis. Sewage water – Steps involved in treatment of sewage.

Practice

1. Estimation of strength of hydrochloric acid by conductometric titration.
2. Estimation of strength of hydrochloric acid by potentiometric titration.
3. Estimation of Iron in Mohr's salt by potentiometric titration.
4. Estimation of hardness of water by complexometry using EDTA.
5. Determination of chloride content in water by Argentometry
6. Determination of viscosity of a given fluid by Ostwald's viscometer.
7. Determination of surface tension of a given liquid by using Stalagmometer.
8. Synthesis of Aspirin.
9. Thin layer chromatography calculation of Rf values. Eg. ortho and para nitro phenols.
10. Determination of partition coefficient of acetic acid between butanol and water.
11. Determination of the rate constant of acid catalyzed hydrolysis of methyl acetate.
12. Preparation of Sanitizer and hand wash.

4. Laboratory Equipment/Software/Tools Required

1. Digital Conductometer
2. Digital Potentiometer
3. Electrical Water Heater
4. Wall Mount Distillation Plant
5. Analytical/Digital Weighing Balance
6. Ostawald's Viscometer
7. Stalagnometer
8. Stopwatch
9. Thermometer
10. RB Flask condenser
11. TLC Plates (silica coated)
12. TLC Chambers
13. Magnetic Stirrer
14. Iodine Blowers

5. Books and Materials

Text Book(s)

1. Jaya Shree Anireddy. *Textbook of Engineering Chemistry*. Wiley Precise Textbook Series, 2018.
2. Chinnappan B, Baskar D, and Dhillon R, *Engineering Chemistry,* Wiley Precise Textbook Series, 2012.

Reference Book(s)

1. Jaya Shree Anireddy, *Textbook of Engineering Chemistry:* As per AICTE, Wiley Precise Textbook Series, 2019.
2. Jain & Jain. *Engineering Chemistry,* Dhanapathrai Publications, 2015.
3. Prasanta Rath, B. Rama Devi, Ch. Venkata Ramana Reddy & Subhendu Chakroborty, *Engineering Chemistry,* Cengage Publications, 2018.
4. C. N. Banwell. *Fundamentals of Molecular Spectroscopy.* McGraw Hill Education India, 4th edition, 2016.

Course Structure
A6007 - Engineering Chemistry

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

This course emphasizes a strong base in physical and general chemistry to spread over an orientation towards the advanced materials. In addition, this also focuses on the general applications to the analysis and evaluation of engineering problems such as water-treatment, batteries, and fuel cells.

Course Pre/co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:
A6007.1. Identify differences and similarities of the Batteries.
A6007.2. Extrapolate the knowledge of electro chemical series to protect different metals from corrosion.
A6007.3. Compare the properties and applications of engineering substances.
A6007.4. Analyze the impurities present in the water for industrial and domestic applications.
A6007.5. Make use of instrumental techniques and titrations to measure physical and chemical properties.

3. Course Syllabus

Theory

Electrochemistry and Batteries: Electrochemistry: Introduction, Electrode– electrode potential, standard electrode potential, types of electrodes– Construction and functioning of Standard hydrogen, Calomel and Quinhydrone electrodes. Engineering Applications: Batteries: Cell and battery – Primary battery (dry cell) and Secondary battery (Lithium-ion cell, lead acid battery, Nickel–Cadmium battery). Fuel cells: Hydrogen–Oxygen fuel cell – Applications.

Corrosion and Its Controlling Methods: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling-Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

Polymers and Fuel Chemistry: A) High Polymers: Introduction, Types of Polymerization. Plastics: Thermoplastic resins & Thermosetting resins, preparation, properties, and engineering applications of plastics: polyethylene, Poly vinyl chloride, Teflon, Nylon. Rubbers: Natural rubber and vulcanization. Synthetic rubbers: Buna-S, Buna-N. Fibers: Polyester- applications. Conducting Polymers: Classification, doping and applications. B) Fuels – Types of fuels, calorific value, numerical problems based on calorific value. Combustion: problems (calculation of amount and volume of oxygen for combustion). Chemical Explosives and Rocket Propellants.

Engineering Materials: Alloys: Introduction - definition, importance of making alloys- Purpose of alloying, Types of alloys- Ferrous Alloys (Stainless steel, Nichrome, Alnico), Non-ferrous alloys (solders, brass, and bronze). Refractories- Classification, Properties, Factors affecting the refractory materials and Applications. Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils and Applications. Building materials- Portland cement, constituents, phases, and reactivity of clinker, Setting and Hardening of cement.

Water treatment: Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness. Numerical problems. Boiler troubles: Sludges, scales, and Caustic embrittlement. Internal treatment of boiler feed water – Calgon conditioning – Phosphate conditioning – Colloidal conditioning – Industrial water treatment – specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards. Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis. Sewage water – Steps involved in treatment of sewage.

Practice

1. Estimation of strength of hydrochloric acid by conductometric titration.
2. Estimation of strength of hydrochloric acid by potentiometric titration.
3. Estimation of Iron in Mohr's salt by potentiometric titration.
4. Estimation of Iron in Cement by Colorimetric titration.
5. Estimation of hardness of water by complexometry using EDTA.
6. Determination of chloride content in water by Argentometry
7. Determination of viscosity of a given fluid by Ostwald's viscometer.
8. Determination of surface tension of a given liquid by using Stalagmometer.
9. Synthesis of Aspirin
10. Synthesis of Polymer (Thiokol Rubber).
11. Determination of the rate constant of acid catalyzed hydrolysis of methyl acetate.
12. Preparation of Sanitizer and hand wash.

4. Laboratory Equipment/Software/Tools Required

1. Digital Conductometer
2. Digital Potentiometer
3. Digital Colorimeter
4. Electrical Water Heater
5. Wall Mount Distillation Plant
6. Analytical/Digital Weighing Balance
7. Ostawald's Viscometer
8. Stalagnometer
9. Stop watch
10. Thermometer
11. RB Flask condenser
12. TLC Plates (silica coated)
13. TLC Chambers
14. Magnetic Stirrer
15. Iodine Blowers

5. Books and Materials

Text Book(s)

1. Jaya Shree Anireddy. *Textbook of Engineering Chemistry*. Wiley Precise Textbook Series, 2018.
2. Chinnappan, B., Baskar, D. and Dhillon, R. *Engineering Chemistry*. Wiley Precise Textbook Series, 2012.

Reference Book(s)

1. Jaya Shree Anireddy.*Textbook of Engineering Chemistry:* As per AICTE. Wiley Precise Textbook Series, 2019.
2. Jain & Jain. *Engineering Chemistry,* Dhanapathrai Publications, 2015.
3. Prasanta Rath, B. Rama Devi, Ch. Venkata Ramana Reddy & Subhendu Chakroborty, *Engineering Chemistry.* Cengage Publications, 2018.
4. C. N. Banwell, *Fundamentals of Molecular Spectroscopy.* McGraw Hill Education India, 4thedition, 2016.

Course Structure
A6008 - Advanced Engineering Chemistry

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

This course offers a strong base in physical and general chemistry to spread over an orientation towards the molecules, general properties of advanced materials and various instrumental techniques. In addition, this course also focuses on fundamental principles of chemistry, potential applications, and practical utility to understand engineering problems.

Course Pre/co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6008.1. Identify differences and similarities of the Batteries.
A6008.2. List the applications of Rotaxanes and Catenanes as artificial molecular machines.
A6008.3. Illustrate the molecular orbital energy level diagram of different molecular species.
A6008.4. Compare the properties and applications of engineering substances.
A6008.5. Analyze the impurities present in the water for industrial and domestic applications.
A6008.6. Make use of instrumental techniques and titrations to measure physical and chemical properties.

3. Course Syllabus

Theory

Electrochemistry and Batteries: Electrochemistry: Introduction, Electrode– electrode potential, standard electrode potential, types of electrodes– Construction and functioning of Standard hydrogen, Calomel and Quin hydrone electrodes. Engineering Applications: Batteries: Cell and battery – Primary battery (dry cell) and Secondary battery (Lithium-ion cell, lead acid battery, Nickel–Cadmium battery).Fuel cells: Hydrogen–Oxygen fuel cell – Applications.

Molecular Machines and Molecular Switches: Concepts and terms of supra molecular chemistry, complementarity, Basic Lock and Key principle, examples of Supramolecules. Molecular recognition- cation binding, anion binding, simultaneous cation and anion binding, supramolecular reactivity, and catalysis. Self-assembly in biological systems, Synthetic systems- catenanes, rotaxanes, metal ion assisted assemblies, template synthesis of macro cyclicligands. Applications of Supramolecular Devices- Ionic devices, Electronic devices, Switching devices and artificial machines.

Structure and Bonding Models: Molecular orbital theory – bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of N_2, O_2 and CO. Calculation of bond order. Crystal field theory – salient features – splitting in octahedral, tetrahedral, and square planar geometry, magnetic and colour properties.

Advanced Engineering Materials: Chemistry of Nanomaterials -Introduction to Nanomaterials, Chemical synthesis of nanomaterials: sol-gel method, precipitation, solvothermal synthesis and thermolysis. Applications of nanomaterials in Industry and engineering. Alloys: Introduction - definition, importance of making alloys- Purpose of alloying, Types of alloys- Ferrous Alloys (Stainless steel, Nichrome, Alnico), Non-ferrous alloys (solders, brass, and bronze). Graphene and Its Applications: Isolation of Graphene, Structure of graphene and strength of graphene. Applications in Computer, Electrical and Electronic Devices.

Water treatment: Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness. Numerical problems. Boiler troubles: Sludges, scales and Caustic embrittlement. Internal treatment of boiler feed water – Calgon conditioning – Phosphate conditioning – Colloidal conditioning – Industrial water treatment – specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards. Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis. Sewage water – Steps involved in treatment of sewage.

Practice

1. Estimation of strength of hydrochloric acid by conductometric titration.
2. Estimation of strength of Acetic acid by conductometric titration.
3. Estimation of strength of hydrochloric acid by potentiometric titration.
4. Estimation of Iron in Mohr's salt by potentiometric titration.
5. Estimation of hardness of water by complexometry using EDTA.
6. Determination of chloride content in water by Argentometry
7. Determination of viscosity of a given fluid by Ostwald's viscometer.
8. Determination of surface tension of a given liquid by using Stalagmometer.
9. Synthesis of Aspirin.
10. Synthesis of Thiokol Rubber.
11. Determination of the rate constant of acid catalyzed hydrolysis of methyl acetate.
12. Preparation of Sanitizer and hand wash.

4. Laboratory Equipment/Software/Tools Required

1. 1.Digital Conductometer
2. Digital Potentiometer
3. Electrical Water Heater
4. Wall Mount Distillation Plant
5. Analytical/Digital Weighing Balance
6. Ostawald's Viscometer
7. Stalagnometer
8. Stopwatch
9. Thermometer
10. RB Flask condenser
11. TLC Plates (silica coated)
12. TLC Chambers
13. Magnetic Stirrer
14. Iodine Blowers

5. Books and Materials

Text Book(s)

1. Jaya Shree Anireddy.*Textbook of Engineering Chemistry*. Wiley Precise Textbook Series, 2018.
2. Chinnappan, B., Baskar, D. and Dhillon, R.*Engineering Chemistry*. Wiley Precise Textbook Series, 2012.

Reference Book(s)

1. Jaya Shree Anireddy, *Textbook of Engineering Chemistry:* As per AICTE. Wiley Precise Textbook Series, 2019.
2. Jain & Jain. *Engineering Chemistry,* Dhanapathrai Publications, 2015.
3. Prasanta Rath, B. Rama Devi, Ch. Venkata Ramana Reddy & Subhendu Chakroborty, *Engineering Chemistry,* Cengage Publications, 2018.
4. C. N. Banwell, *Fundamentals of Molecular Spectroscopy.* McGraw Hill Education India, 4th edition, 2016.

Course Structure
A6009 - English For Communication

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	2	28	0	28	3	30	70	100

1. Course Description

Course Overview

This course has been designed to develop linguistic and communicative competencies among engineering students. Focus has been given to all the four skills of language; Listening, Speaking, Reading, and Writing. Listening and Speaking skills of the students are designed to be honed in the ELCS lab with the help of a lab manual. The topics related to ELCS lab are phonetics, word accent and intonation, making effective oral presentations, role- play, telephonic skills, asking for and giving directions, and listening skills. In the ELCS lab the students are trained to work in a group, engage in peer-reviews and inculcate team spirit through various exercises by participating in activities. The Reading and Writing skills of students are polished in the theory classrooms using prescribed textbook with additional focus on grammar and vocabulary. In addition, the students are encouraged to read texts/poems which are aimed at developing their comprehension skills as well as their idea of language analysis.

Course Pre/co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6009.1. Build competence in grammar and vocabulary.
A6009.2. Develop pronunciation as well as listening capabilities.
A6009.3. Develop effective academic reading skills.
A6009.4. Identify problems in speaking and building their presentation skills.
A6009.5. Construct effective academic writing skills.

3. Course Syllabus

Theory

Vocabulary: Word Formation – Prefixes – Suffixes, Synonyms, Antonyms, Homonyms, Homophones, Homographs, Idioms, Phrasal Verbs, One Word Substitutes

Grammar: Articles, Prepositions, Types of Sentences, Tenses: Present, Past and Future Concord: Subject-Verb Agreement, Noun-Pronoun Agreement, Active-Passive Voice, Conjunctions, Degrees of Comparison, Direct-Indirect Speech, Common Errors: Redundancies– Clichés – Misplaced Modifiers

Reading: Units from the Textbook: Presidential Address by APJ Abdul Kalam- Satya Nadella's Email to his Employees on his First Day as CEO of Microsoft- The Road Not Taken by Robert Frost- Good Manners by J C Hill- Oh Father, Dear Father by Raj Kinger.

Writing I: Paragraph Writing: Devices of Paragraph Writing - Cohesion - Coherence- Punctuation, Essay Writing, Précis Writing, Note Making and Note Taking.

Writing II: Letter Writing -Letters of Request, Letters of Inquiry, Letters of Apology, Letter of Complaint, Resume Writing/ CV, Cover Letter, Information Transfer.

Practice

1. Ice Breaking and JAM & Introduction to Phonetics
2. Speech Sounds: Vowels and Consonants
3. Past Tense Marker/ Plural Marker/Syllable Structure
4. Consonant Clusters and Minimal Pairs
5. Situational Dialogues and Role Plays
6. Word Accent and Stress Shift/Weak Forms and Strong Forms
7. Asking and Giving Directions/Seeking Clarifications/Agreeing and Disagreeing
8. Neutralization of MTI/ Differences Between British and American Pronunciation
9. Intonation Pattern – Types of Tones/ Sentence Stress
10. Social and Professional Etiquette
11. Listening Skills – Theory and Practice
12. Oral Presentation – Students' Presentation

4. Laboratory Equipment/Software/Tools Required

1. Computers with internet
2. K-VAN Solutions Software
3. Headphones
4. Audio Visual Equipment

5. Books and Materials

Text Book

1. *Fluency in English – A Course Book for Engineering Students* (by Board of Editors: Orient Blackswan Pvt. Ltd, Hyderabad, 2016.

Reference Books

1. Mohanraj, J., *Let Us Hear Them Speak,* Sage Texts. Print, New Delhi, 2015.
2. Raman, Meenakshi and Sharma, Sangeeta, *Technical Communication- Principles and Practice*, 3rd Edition, Oxford University Press, New Delhi. Print, 2015.
3. Hancock, M., *English Pronunciation in Use* Intermediate, Cambridge University Press. Print, Cambridge, 2009.
4. *Exercises in Spoken English,* Parts I-III CIEFL, Oxford University Press, Hyderabad.

Course Structure
A6010 - Business English

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
1	0	2	14	0	28	2	30	70	100

1. Course Description

Course Overview

This course has been designed to prepare the students to learn the language required for business communication and to take Business English Certificate (BEC) examination at the Vantage level conducted by the University of Cambridge. Business communication differs from ordinary communication and requires a more formal language, vocabulary, ability to understand different cultural backgrounds of people and neutral intonation. Therefore, the course is prepared to cater the needs of students in developing their four skills of business communication and move a step ahead towards professional development. This course is offered in continuation to the English for Communication taught during the first semester. It focuses on receptive and productive skills. The classes will be theory and also activity based, with the language lab to be used for practice.

Course Pre/co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6010.1. Build competence in grammar and vocabulary.
A6010.2. Select reading skills in terms of business language.
A6010.3. Develop writing skills for business communication.
A6010.4. Develop confidence in speaking skills and presentation skills.
A6010.5. Make use of listening skills in different business contexts.

3. Course Syllabus

Theory

Grammar: Countable and Uncountable nouns, Noun phrases, Adjective forms, Infinitive or present participle, Prepositions in phrases, Formal requests, First, second and third conditionals, Modal verbs: perfect forms, Using the passive to express opinions and ideas, reporting verbs, and reported speech, Relative clauses.

Vocabulary: Acronyms for job titles and Job descriptions, Phrases expressing enthusiasm, Collocations describing reasons for meeting, Verb-Noun collocations, Words, and phrases expressing numbers, Adjective-Noun collocations.

Language work: Asking questions, expressing likes, introducing reasons, talking about large and small differences, expressing results.

Reading: Scanning: Identifying Specific Information, reading for gist, understanding text structure; Business Vocabulary Comprehension: words, phrases, and idioms in business context; Proofreading: Understanding sentence structure and identifying errors.

Writing: Writing official messages, Memo and Emails: Giving Instructions, explaining a development, Asking for comments, Requesting information, Agreeing to requests; Business correspondence: Short report and Proposal.

Practice

1. Self-Introduction
2. Listening to Monologues and Dialogues
3. Listening to Group Conversation
4. Mini presentation on business themes
5. Collaborative Tasks**:** Negotiating, Collaborating
6. Exchanging information, Expressing, and justifying opinions
7. Agreeing and/or disagreeing, Suggesting, Speculating
8. Comparing and contrasting, and Decision-making
9. Brain storming ideas for mini presentation
10. Note Making while preparing for speaking.

NOTE: This syllabus has been taken from Business English Certificate (BEC), Cambridge University Press.

4. Laboratory Equipment/Software/Tools Required

1. Computers with Internet
2. Audio Visual Equipment
3. Headphones

5. Books and Materials

Text Book

1. Brook-Hart, Guy. *Cambridge English Business Benchmark- Upper Intermediate Business Vantage* (with CD), 2nd Edn., South Asian Edition. Cambridge University Press. Reprint. 2019.

Reference Book(s)

1. Whitby, Norman. *Cambridge English Business Benchmark- Upper Intermediate*. Cambridge University Press. 2014.
2. Cambridge BEC resources (Web): https://www.cambridge.org/gb/cambridgeenglish/catalog/cambridge-english-exams-ielts/bec/resources

Course Structure
A6201 – Basic Electrical Engineering

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

Basic Electrical Engineering is an integrated course intended to enhance the knowledge of students in electric circuits, DC & AC machines and develop analytical skills. The course addresses the underlying concepts and methods behind Electrical Engineering. The course presents the knowledge of the Fundamentals of Electrical Engineering, basic principles, types of electrical circuit and network theorems. The principle and operating conditions of D.C. Machines (Motor & Generator), Transformers, Induction Motors and alternators will be discussed.

Course Pre/Co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6201.1. Apply network reduction techniques and knowledge of alternating quantities to calculate current, Voltage and Power for complex circuits.

A6201.2. Analyze the electrical circuits using Nodal Analysis, Mesh Analysis and Network Theorems.

A6201.3. Plot and analyze the characteristics of DC machines, AC Machines and 1-PhaseTransformers.

A6201.4. Test the performance of DC Machines, 1-Phase Transformers and AC Machines.

3. Course Syllabus

Theory

DC Circuits: Electrical circuit elements (R, L and C), Types of sources, Ohm's Law, KVL&KCL, Network reduction Techniques (Series, Parallel & Star-Delta), Mesh and Nodal Analysis, Thevenin's, Norton's and Superposition Theorem (DC Excitation).
Network Parameters: Two port network parameters, Z, Y, and hybrid parameters.

AC Circuits: Representation of sinusoidal waveforms, Average & RMS value, Peak factor, Form factor, j-notation, Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series), Active power, Reactive power, Apparent power, and power factor.

Single Phase Transformers: Principle & constructional details and types, EMF equation, operation on NO load and ON load Condition, Phasor diagrams. Equivalent circuit, losses, and efficiency. OC and SC test, Applications.

DC Machines: D.C. Generators - Principle of operation, E.M.F. Equation, Methods of Excitation - separately excited and self-excited generators, Characteristics. D.C Motors – Principle of operation - Back E.M.F, Torque equation, torque-speed characteristics of DC motors, Applications.

AC Machines: Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, torque-slip characteristics, Applications. Construction and working of synchronous generator, No-Load Characteristics, types, Applications.

Practice

1. Verification of Ohm's Law
2. Verification of Thevenin's and Norton's theorems.
3. Verification of superposition theorems.
4. Verification of Z and Y parameters.
5. Verification of KVL and KCL.
6. Calculations and Verification of Impedance, Voltage and Current of RL, RC series circuits.
7. Load Test on Single Phase Transformer.
8. O.C. & S.C. Tests on Single phase Transformer.
9. Torque-Speed Characteristics of a DC Compound Motor.
10. Brake test on a 3 phase Induction Motor.
11. Performance Characteristics of a Separately Excited DC Motor.
12. No-Load Characteristics of a Three-phase Alternator.

4. Laboratory Equipment/Software/Tools Required

1. Bread Board, Resistors of different values, Regulated Power supply, CRO, Function Generator.
2. 1-Phase Transformer, voltmeter, Ammeter, Wattmeters (LPF and UPF).
3. Voltmeter, Ammeter, Tachometer, Rheostat.

5. Books and Materials

Text Books

1. William Hart Hayt, Jack Ellsworth Kemmerly, Steven M. Durbin (2007), *Engineering Circuit Analysis,* 7th edition, McGraw-Hill Higher Education, New Delhi, India
2. B.L. Theraja, A.K. Theraja, A text book of Electrical Technology, (Vol 1 & 2), S. Chand Publishers, New Delhi.

Reference Books

1. D. P. Kothari and I. J.Nagrath, *Basic Electrical Engineering*, 3rd edition 2010, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, *Basic Electrical Engineering*, McGraw Hill, 2009.
3. L. S. Bobrow, *Fundamentals of Electrical Engineering*, Oxford University Press, 2011.

Course Structure
A6202 – Circuit Theory

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

Circuit Theory is an integrated course intended to enhance the knowledge of students in electric circuits and develop analytical skills. This course provides basics of network theorems and its application to solve DC and AC circuits. This course provides basics of network theorems and its application to solve DC and AC circuits. This course also introduces self & mutual inductances and series resonance. Students will learn the concepts of two-port networks and network transients.

Course Pre/Co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6202.1. Illustrate KVL, KCL, nodal analysis, mesh analysis, AC fundamentals of electrical circuits.
A6202.2. Apply network theorems to simplify complex electrical circuits.
A6202.3. Apply the concept of resonance to electrical networks to determine resonant Frequency, bandwidth, and Q-factor.
A6202.4. Analyse self-inductance and mutual inductance of coupled circuits.
A6202.5. Determine various parameters of a given two-port networks.
A6202.6. Analyse DC and AC transients for given electrical circuit using differential equations.

3. Course Syllabus

Theory

DC Circuits: Electrical circuit elements (R, L and C), Types of sources, Ohm's Law, KVL & KCL, Network reduction Techniques (Series, Parallel & Star-Delta), Mesh and super mesh and node and super node analysis. Network Theorems: Thevenin's, Norton's, Superposition, Reciprocity, Maximum Power Transfer theorem, Tellegan's theorem.

AC Circuits: Representation of sinusoidal waveforms, Average & RMS value, Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series), Single phase and Three phase Systems, Active power, Reactive power, Apparent power, complex power, and power factor.

Resonance: Series resonance, resonant frequency, concept of band width and q-factor.
Coupled circuits: Self-inductance and Mutual inductance, Coefficient of coupling, dot convention.

Network Parameters: Two port network parameters - Z, Y, hybrid parameters and Transmission parameters (DC Excitation), relationship between various parameters, numerical problems.

Transients: Initial condition, Transient response of series RL, RC, and RLC networks by differential equations with DC excitation and AC excitation, numerical problems.

Practice

1. Verification of Ohm's Law
2. Verification of KVL and KCL
3. Calculation and Verification of Impedance, Voltage and Current of RL, RC and RLC series circuits.
4. Verification of superposition theorem
5. Verification of Thevenin's and Norton's theorems
6. Verification of Maximum power transfer theorems
7. Determination of Resonant frequency and bandwidth of series RLC circuit
8. Determination of self, mutual inductance, and coefficient of coupling
9. Determination of Z and Y parameters
10. Determination of Hybrid and Transmission parameters
11. Transient analysis of series RL circuits
12. Transient analysis of series RC circuits

3. Laboratory Equipment/Software/Tools Required

1. Verification of Ohm's Law Kit
2. Verification of KVL and KCL Kit
3. Calculation and Verification of Impedance, Voltage and Current of RL, RC and RLC series circuits kit
4. Verification of superposition theorem kit
5. Verification of Thevenin's and Norton's theorems kit
6. Verification of Maximum power transfer theorems kit
7. Function generator
8. Single phase transformer
9. DRB, DLB, DCB
10. Determination of Z and Y parameters kit
11. Determination of Hybrid and Transmission parameters kit
12. Transient analysis of series RL/RC circuits kit
13. Digital Oscilloscope

5. Books and Materials

Text Books:

1. William Hart Hayt, Jack Ellsworth Kemmerly, Steven M. Durbin (2007), Engineering Circuit Analysis,8th edition, McGraw-Hill Higher Education, New Delhi, India, 2018.
2. Charles K. Alexander and Matthew N.O. Sadiku, Fundamentals of Electric Circuits, 7th Edition, McGraw Hill Education, 2015.

Reference Books:

1. A.Sudhakar, Shyammohan S. Palli , Network Analysis, 4thEdition, Tata Mc Graw Hill, NewDelhi, 2009.
2. A.Chakrabarthy (2010), *Electrical Circuits, 5*rd edition, Dhanpat Rai & Sons Publications, New Delhi,2010.

Course Structure
A6301 – Engineering Graphics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
1	0	4	14	0	56	3	30	70	100

1. Course Description

Course Overview

Engineering drawing is said to be the language of engineers. It is the graphical representation of objects and their relationships based on certain basic principles and standard conventions. It can be regarded as a powerful tool to convey ideas. This course is included in all engineering curricula with the aim of training the students and making them graphically literate. This course covers orthographic projections for points, lines, planes and solids in different positions, the development of lateral surfaces and the isometric projections. The students are able to create simple solid models of various domain applications.

Course Pre/co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6301.1. Construct various types of curves commonly used in engineering practice.

A6301.2. Distinguish between first, second, third and fourth angle projections of systems.

A6301.3. Estimate lateral surface of the sheet metal requirement for making regular solids.

A6301.4. Compare isometric and orthographic views of an object.

A6301.5. Select CAD tools for drafting regular solids.

3. Course Syllabus

Theory

Introduction to Engineering Drawing: Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Lettering and dimensioning, Conic Sections – General method only.

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of points, lines, and planes - inclined to one plane and inclined to both the principal planes.

Projections of Regular Solids: Orthographic projections of Prism, Cylinder, Pyramid and Cone inclined to one of the principal plane.

Development of Lateral Surfaces: Development of lateral surfaces of Regular Solids – Prism, Cylinder, Pyramid and Cone.

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple Solids. Conversion of Isometric Views to Orthographic Views and Vice-versa.

Practice

1. Introduction to engineering drawing
2. Lettering and dimensions- Geometrical Constructions (Construction of different Polygons)
3. Conic sections
4. Projection of points (Orthographic, First and Third angle)
5. Projection of Lines
6. Projection of planes (Regular Planes inclined to one reference plane)
7. Projection of planes (Inclined to both the planes)
8. Projections of regular Solids (Regular solids parallel to one of the planes)
9. Projections of regular Solids (inclined to a plane and parallel to other plane)
10. Development of surfaces (Prisms and cylinders)
11. Development of surfaces (Pyramids and cones)
12. Isometric Projections

4. Laboratory Equipment/Software/Tools Required

1. PC installed with operating system (Windows)
2. Auto cad software

5. Books and Materials

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., Engineering Drawing, Charotar Publishing House, 2014.
2. Basant Agrawal B. & Agrawal C. M., Engineering Graphics, TMH Publication, 2016.

Reference Books:

1. Narayana, K.L. & P Kannaiah, Text book on Engineering Drawing, Scitech Publishers, 2016.
2. K. Balaveera Reddy et al, Computer Aided Engineering Drawing, CBS Publications, 2017
3. Shah, M.B. & Rana B.C., Engineering Drawing and Computer Graphics, Pearson Education, 2008

Course Structure
A6302 – Engineering Workshop

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

Engineering Workshop is an establishment of space and facility where the students acquire the knowledge on different materials, equipment, tools and workshop practices that are the core methods of engineering industry. This course is of prime importance which makes the learner competent in handling practical work in all types and trades of engineering. It also develops the skills with dignity of labour, precision, safety at work place, team working innovative ideas in making and development of right attitude.

Course Pre/co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6302.1. Identify the different materials and tools applied to each trade.

A6302.2. Demonstrate each trade by preparing the required model.

A6302.3. Analyse the model/component and selection of the trade-based operations.

A6302.4. Examines each tool and deducts its working procedure.

A6302.5. Classify different workshop practice methods.

3. Course Syllabus

PART – A (Demonstration)

Workshop Practice:

1. CNC Machining
2. Additive Manufacturing with one Model
3. Power Tools, Plastic Moulding, Metal Casting
4. Welding (TIG/MIG, Gas Welding), Brazing

PART - B (Practical)

1. Fitting : L - Fit / V - Fit / Square – Fit / Semi Circular - Fit
2. Carpentry : Cross Lap Joint / Dovetail Joint / T – Lap Joint / Corner Lap Joint
3. House wiring : Series / Parallel / One Bulb One Switch / Tube Light / Two-way switch
4. Welding : Butt Joint / Lap Joint / T Joint
5. Foundry : Single Piece / Multi Piece
6. Tin Smithy : Open Scoop / Funnel / Rectangular Tray / Cylindrical
7. Plumbing : Pipe Threading / Pipe Joints

Note: Minimum one experiment from each Trade with total of 12 Experiments

4. Laboratory Equipment / Software / Tools Required

1. Fitting : Bench vise, Hacksaw frame, Calipers, Files, Try Square
2. Carpentry : Carpentry vise, Chisels, Saws, Wooden Hammer, Try Square
3. House wiring : Wiring Bundles, Socket Pins, Tester, Poker, and Cutting Plier
4. Welding : Welding M/c, Safeguards, Chipping Hammer, Electrode Holder
5. Foundry : Wooden patterns, Riddle, Riser, Runner, Gate cutter, Rammers
6. Tin Smithy : Wire Gauge, Snips, Pliers, Steel rule, Soldering kit, Nylon Hammers.
7. Plumbing : Pipe Wrench, Pipe Cutter, Pliers, Pipe Die Set
8. Additional : Model Joints & Electric Boards

5. Books and Materials

Text Books:

1. B L. Juneja, "Workshop Practice", 1st Edition, Cengage Learning India Private Limited, New Delhi, 2015.
2. S.K. Hajra Choudary, “Elements of Workshop Technology- Vol I & Vol II”, 9th Edition, Media Publishers & Promoters, 1985

Reference Books:

1. K. Venkata Reddy," Workshop Manual", 6th Edition Reprint, BSP Publications, Hyderabad, 2018.
2. S Gowri & T Jeyapoovan, Engineering Practices Lab Manual, 5th Edition, Vikas Publishing House Private Limited, New Delhi, 2017.

Course Structure
A6303 – Engineering Mechanics

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

Engineering Mechanics is a branch of Physical Science which uses the Laws of Mechanics to predict forces and torques and its effects on the motion of rigid bodies. The course covers a basic introduction to both statics and dynamics. This course is the key prerequisite course to sequences of courses dealing with mechanics of solids, Kinematics and Dynamics of Machinery and Design of Machine Members.

Course Pre/co-requisites

A6001 - Linear Algebra and Ordinary Differential Equations
A6004 - Engineering Physics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:
A6303.1 Illustrate the types of forces and moments acting on a rigid body.
A6303.2 Apply the laws of mechanics to evaluate different types of forces acting on a rigid body.
A6303.3 Identify the centroid and moment of inertia of composite bodies.
A6303.4 Apply the basic concepts of kinematics and kinetics to solve numerical problems.
A6303.5 Measure the forces by using laws of mechanics on different bodies experimentally.

3. Course Syllabus

Theory

Introduction to Engineering Mechanics – Basic Concepts, Resultants of Force System, Parallelogram law, Forces and components, Resultant of coplanar Concurrent Forces, Components of forces in Space, Moment of Force, principle of moments, Coplanar Applications, Couples, Resultant of any Force System. Equilibrium of Force Systems, Free Body Diagrams, Equations of Equilibrium, Equilibrium of planar Systems.

Friction - Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, Ladder friction, wedge friction.

Centroid and Centre of Gravity - Centroid of simple figures from first principle, centroid of composite sections, Pappus theorems. Centre of Gravity and its implications, centre of gravity of composite sections.

Area moment of inertia - Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections. Mass moment inertia of circular plate, Cylinder, Cone, Sphere, mass moment of inertia of composite bodies.

Dynamics of Particles - Work Energy Equation, Conservation of energy, Impulse and Momentum principle, direct central collisions, coefficient of restitution.

Practice:

1. To verify the law of Force Polygon with the help of force polygon apparatus.
2. To verify Lami's Theorem.
3. To Determine the resultant of Coplanar force system by graphical Method.
4. To Determine the resultant of concurrent force system by graphical Method.
5. To find the forces in the members of Jib Crane.
6. To verify the law of Moments using Parallel Force apparatus (simply supported type).
7. To verify the law of moments using Bell crank lever.
8. To determine the co-efficient of friction between steel and various surfaces (like Leather, Wood, Aluminium) on an inclined plane.
9. To determine the co-efficient of friction for different materials.
10. To determine the centre of Gravity by graphical Method.
11. To determine the Moment of Inertia of Flywheel.
12. To determine the radius of gyration and the moment of Inertia of a given circular plate.

Note: Minimum ten experiments need to be conducted.

4. Laboratory Equipment/Software/Tools Required

1. Force polygon apparatus
2. Lamî's Theorem apparatus
3. Coplanar force system
4. Concurrent force system
5. Jib Crane apparatus
6. Parallel Force apparatus
7. Bell crank lever apparatus
8. Inclined plane Apparatus
9. Coefficient of friction apparatus
10. Centre of gravity apparatus
11. Flywheel apparatus
12. Tri-Filar suspension apparatus

5. Books and Materials

Text Books

1. Ferdinand. Singer, *Engineering Mechanics, "Statics and Dynamics*", India: Harper International Edition, 2013.
2. R.C. Hibbler, *Engineering Mechanics*, New Jersey: Prentice Hall, 2009.

Reference Books

1. Ferdinand P. Beer, *Vector Mechanics*, India: Mc-Graw Hill, 2019.
2. N.H. Dubey, *Engineering Mechanics-Statics and Dynamics*,India: Mc-Graw Hill-India, 2013.
3. J.L Meriam & L.G. Kraige, *Engineering Mechanics-Statics*, India: Wiley, 2020.
4. R.K. Rajput, *A Text Book of Applied Mechanics*,India: Laxmi Publications,2012.
5. S.S. Bhavikati& K.G. Rajasekharappa, *Engineering Mechanics*, India: New age publications, 2015

Course Structure
A6501 – Problem Solving with Python

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	2	28	0	28	3	30	70	100

1. Course Description

Course Overview

As an introductory course common to all branches, the student will be able to learn problem solving skills using **'PYTHON'** programming language, which is a pre-requisite to learn many other programming Languages. The purpose of this course is to provide the basic programming methodology in Python. This course will enable the students to learn programming skills necessary to implement all the basic mathematical, scientific, and real-world applications. Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. This course will give the foundation for a beginner to develop computer programmes effectively.

Course Pre/Co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:
A6501.1. Identify the various building blocks to write a Python program.
A6501.2. Use control statements for solving a given problem.
A6501.3. Implement fundamental data structures for manipulating data.
A6501.4. Build user defined functions to improve code reusability.
A6501.5. Use File concepts to store and retrieve data from disk.

3. Course Syllabus

Theory

Introduction to Python Programming: Introduction to Python, Features of Python, Identifiers, Reserved Words, Data Types, Variables and Constants, Input / Output Statements, Type Casting, Operators, Operator Precedence and Associativity, Expressions Evaluation

Control Statements: Conditional Statements - if, if-else, if-elif-else. Iterative Statements –for, while. Jump / Transfer Statements –continue, break, pass.

Strings and Operations: String definition, Slicing, Mathematical Operations on Strings, Checking Membership, Comparison, Formatting Strings, Built in Functions and Methods. **Data Structures and Operations** -Sequence, Lists, Tuple, Set and Dictionary – Definition, operations, and functions.

User Defined Functions: Introduction, Function Definition, Function call, Type of Arguments, Return Statement, Recursion, Lambda function, Range.

File Handling: Introduction, Opening and Closing a file, Reading from a file and writing to a file. Copy and Merge operations on files.

Practice

Week-1: Introduction to Python Lab – Installation and Simple Output Display.

- Write a python program to read a string "Python Programming" and display it on the screen.
- Write a python program to read integer, float & string values and display them on the screen.

Week-2: Programs using Input Output Statements, Variables and Expressions

- Write a python program to read a float value and convert Fahrenheit to Centigrade.
- Write a python program to find the area of triangle.
- Write a python program to read the Marks in 4 Subjects and Display the average.
- Write a python program for demonstrating the usage of command line arguments

Week-3: Programs using various operators in Python

- Write a python program for demonstrating the usage of comparison operators.
- Write a python program to swap / interchange two numbers.
- Write a program that asks the user for a number of seconds and prints out how many minutes and seconds in it. For instance, 200 seconds is 3minutes and 20seconds.
- Write a python program for demonstrating the usage of unary, shift, logical, membership and identity operators**.**

Week-4: Programs using Conditional Statements

- Write a python program to check a given number is Even or Odd.
- Write a python program that asks the user to enter a length in centimetres. If the user enters a negative length, the program should tell the user that the entry is invalid. Otherwise, the program should convert the length to inches and print out the result.
- Write a python program to find the greatest of 3 integer numbers.
- Write a python program to demonstrate nested if statement.

Week-5: Programs using Iterative Statements

- Write a Python program to reverse the digits of a given number.
- Write a Python program to find the factorial of a given number.
- Write a python program to find the GCD of given two numbers.
- Write a python program to display factors of a given integer number.

Week-6: Programs using Iterative Statements

- Write a python program to display all prime numbers between 0 to n.
- Write a program to print all Armstrong numbers between given range using for loop.
- Write a Python program to display a simple pyramid pattern for demonstrating nested loop.

Week-7: Programs using Strings and Its Operations

- Write a program that asks the user to enter a string and perform the following:
  (a) The total number of characters in the string.
  (b) Repeat the string 10 times.
  (c) The first character of the string.
  (d) The first three characters of the string.
  (e) The last three characters of the string.
  (f) The string in backwards.
  (g) The seventh character of the string if exist otherwise display a message "Not exist".

(h) The string with its first and last characters removed.
(i) The string into capital case.
(j) The string with every **a** replaced with an **e.**
(k) The string with every letter replaced by a space.

Week-8: Programs using Strings.

- Write a python program to read a string and find the number of characters in it (Without using Built in Functions).
- Write a Python program to read a String and check whether the string is palindrome or not (Without using Built in Functions).

Week-9: Programs using Python Data Structures (Lists).

- Write a python program to perform following operations on a list of integers.
  (a) Print the total number of items in the list.
  (b) Print the last item in the list.
  (c) Print the list in reverse order.
  (d) Print Yes if the list contains a 5 and No otherwise.
  (e) Print the number of occurrences of a element in the list.
  (f) Remove the first and last items from the list and sort the remaining items.
  (g) Print how many integers in the list is less than a given value?
  (h) Print the average of the elements in the list.
  (i) Print the largest and smallest value in the list.
  (j) Print the second largest and second smallest entries in the list.
  (k)Print number of even numbers in the list.

Week-10: Programs using Python Data Structures (Dictionary).

- Write a python program for demonstrating the creation of dictionary, accessing dictionary elements, modifying dictionary elements, finding length and possible operations.
- Write a python program to create a dictionary of students with keys as roll numbers and values as names. Perform operations like insert, update, and modify student data.
- Write a program that uses a dictionary that contains ten usernames and passwords. The program should ask the user to enter username and password. If the username is not in the dictionary, the program should indicate that the person is **"not a valid user"** of the system. If the username is in the dictionary, but the user does not enter the right password, the program should say that "**the password is invalid"**. If the password is correct, then the program should display **"Welcome".**

Week-11: Programs using Python Data Structures (Tuples and Set) .

- Write a python program to demonstrate various operations on tuples.
- Write a python program to demonstrate various operations onsets.

Week-12: Programs using User Defined Functions.

- Write a Python program to calculate simple interest using function.
- Write a Python program to find the nth term of a Fibonacci number using function.
- Write a Python program to find the number of elements in a list using function.
- Write a python program to find factorial of a given number using recursion.
- Write a python program to find sum of individual digits of a given number using recursion

Week-13: Programs using File Handling in Python.

- Write a Python program to read data from a source file and copy its content in to a destination file.
- Write a python program to display the number of characters, digits and special characters present in the given file content.
- You are given a file calledgrades.txt, where each line of the file contains a one-word student username and three test scores separated by spaces, like below:
  - Rathan 83 77 54
  - Adams 86 69 90

  Write code that scans through the file and determines how many students passed all three tests.

4. Laboratory Equipment/Software/Tools Required

1. A computer System with Windows / Ubuntu Operating System.
2. Python 3.x (Any Latest Version)
3. A text editor Notepad++ (Windows) / Gedit (Ubuntu) / PyCharm IDE

5. Books and Materials

Text Book:

1. Reema Thareja, Python Programming using Problem solving Approach. Oxford University Press, New Delhi India, 2017.

Reference Books:

1. Timothy A Budd, Exploring Python, Tata McGraw Hill Education Private Limited. New Delhi India, 2008.
2. Mark Lutz, Learning Python, 5th Edition. O'Reilly, USA, 2015.
3. Brian Heinold, A Practical Introduction to Python Programming, 2012.

Course Structure
A6502 – Data Structures

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

Data Structures is a course for an engineering graduate to improve the programming skills using C Language. It is a logical model of organizing data, used in designing and implementing efficient algorithms. Data structures are important as they are implemented in every software application. The study of C programming language covers the various building blocks, control statements, arrays, functions, pointers and structures. C programming language Concepts are used to implement Data Structures. Data structures course cover implementing stacks and queues using arrays and linked lists. The course also includes fundamental terminology of non-linear data structures like Trees and Graphs which are especially used to handle large amount of data. The course will also enable the use of appropriate searching and sorting method in handling collection of elements.

Course Pre/co-requisites

A6501 – Problem Solving with Python

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6502.1. Identify the various building blocks to write a C program.
A6502.2. Use control statements and functions to solve a given problem.
A6502.3. Apply Linear Data Structures concepts for manipulating data.
A6502.4. Implement operations of non-linear data structures for handling large data.
A6502.5. Select appropriate sorting and searching technique for a given application.

3. Course Syllabus

Theory

Introduction to C Programming: Structure of a C program, Variables and Constants, data types, operators, type conversion and formatted input/output functions.

Control Statements and Functions: Conditional Statements – if, if-else, else-if ladder, switch statements, Iterative Statements – for, while, do-while statements. Jump Statements –continue, break, and return statements. Introduction to functions, Function Definition, Categories of Functions, Parameter passing techniques, Recursion.

Linear Data Structures: Introduction to Arrays, One dimensional and two-dimensional arrays. Introduction to Strings**,** String handling functions and Array of Strings. Structures-Declaration, initialization, accessing the members of structures, Pointer to structures, self-referential structure. Introduction to Data Structures,

Stacks- Introduction, Stack Operations, Types of Expressions-Infix, Prefix and Post fix. Infix to Postfix conversion, Evaluation of Postfix Expression. Queues – Introduction, Queue Operations.

Dynamic Memory Allocation and Linked Lists: Pointers- Declaration, initialization, pointer to pointer, pointer arithmetic, dynamic memory allocation, command line arguments. Linked Lists-Introduction, Creating Singly Linked List and Perform insert, delete, and display operations. Stack and Queue operations using Singly Linked List.

Non-Linear Data Structures, Searching and Sorting: Introduction, Basic Terminologies, Representation of Binary Tree and Tree Traversal Techniques. Graphs: Definition, Basic Terminologies and Representation. Introduction to Searching, Linear search, binary search. Introduction to sorting, bubble sort, selection sort, insertion sort.

Practice

Week-1: Introduction to C Lab, Basic Input – Output Operations.

a) Write a C program to print your name and address in line by line.
b) Write a C program to calculate simple interest.
c) Write a C program for Swapping of two numbers using a third variable.

Week-2: Programs using Control Statements (Conditional).

a) Write a C program to check a character is Vowel or Consonant.
b) Write a C program to perform arithmetic operations using switch statement.
c) Write a C program find the net salary of employee based on the allowances. (Use else-if ladder).

Week-3: Programs using Control Statements (Iterative).

a) Write a C program to check a given number is palindrome number or not.
b) Write a C program to check a number if perfect number or not.
c) Write a C program to display Fibonacci numbers up to a given value.

Week-4: Programs using Arrays.

a) Write a C program to find the largest and smallest number among a list of integers.
b) Write a C Program to read an array of n elements and find the sum of all even integers and odd integers.
c) Write a C program to find Multiplication of two matrices.

Week-5: Programs using Strings.

a) Write a C program to demonstrate the string handling functions.
b) Write a C program to Check whether a given string is palindrome or not without using string functions.
c) Write a C Program to concatenate two string and copy into a new string without using string functions.
d) Write a C Program to read two strings and display them in dictionary order.

Week-6: Programs using Functions and Structures.

a) Write a C program to find the factorial of a number using non recursive function.
b) Write a C program to find the factorial of a number using recursion.
c) Write a C program to find the n^{th} Fibonacci term using recursion.

d) Write a C program to create a Student structure containing name, roll number and grade as structure members. Display the name, roll number, and grade of a student.

Week-7: Programs using linear search and binary search.

a) Implement Linear Search
b) Implement Binary search

Week-8: Programs using bubble, insertion, and selection sort.

a) Implement Bubble sort
b) Implement Selection sort
c) Implement Insertion sort

Week-9: Program to perform Stack operations.

a) Implement stack operations using arrays.

Week-10: Programs to Convert Infix Expression to Postfix, Evaluating Postfix expression.

a) Converting infix expression to postfix expression
b) Evaluate the postfix expression

Week-11: Program to perform Queue Operations.

a) Implement Queue using arrays.

Week-12: Programs using singly linked list to perform insert, delete and display.

a) Implement single linked list.

Week-13: Programs using singly Linked List to create stack and Queue.

a) Program to implement stack operations using singly linked list
b) Program to implement queue operations using singly linked list.

Week-14: Programs using Binary Tree and Tree Traversal.

a) Implement Traversals on Binary Tree using linked list.

4. Laboratory Equipment/Software/Tools Required

- A computer System with Windows / Ubuntu Operating System.
- C/C++ Compiler
- A text editor Notepad++ (Windows) or Gedit (Ubuntu) or IDE for C/C++.

5. Books and Materials

Text Books:

1. Reema Thareja. Data Structures Using C. 2nd Edition.Oxford University Press, New Delhi India, 2014.

Reference Books:

1. Samanta Debasis. Classic Data Structures. 2nd Edition. Prentice Hall of India, New Delhi, India, 2012.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed. Fundamentals of Data Structure in C. 2nd Edition. University Press, India, 2008.
3. Yeshvanth Kanethkar. Let Us C, BPB Publications. 5th edition, New Delhi / India, 2017.

Course Structure
A6021 - Social Innovation

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

Social Innovation is an open-ended course to develop social connectedness in engineering students through social awareness and social consciousness. This can be done through live field exposure along with faculty led conceptual presentations, real case reviews, self-study assignments, literature and field survey. Through this course, the students are expected to use their engineering knowledge to provide innovative solutions to existing social problems. This course also develops critical thinking ability among the students to develop sustainable solutions.

Course Pre/co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6021.1. Develop awareness on social issues faced by local regions.
A6021.2. Identify the mind set of human Race and interpret the societal issues as simple, complicated, and complex problems.
A6021.3. Identify the need statement along with its main causes and effects.
A6021.4. Develop an innovative and sustainable solution for social issues by thinking critically and creatively.

3. Course Syllabus

Module 1. Introduction to Social Innovation: Core definitions, core elements and common features of social innovation, a typology of social innovation, Awakening social consciousness.
Module 2. Create Mindsets and Wicked Problems: Seven mindsets – Empathy, Optimism, Iteration, Creative confidence, making it, embracing ambiguity, Learning from failures. Distinguish between simple, complicated, and complex problems; describe the characteristics of wicked problems, breakdown a given problem by unpacking its complexity.
Module 3. Critical and Creative Thinking for Social Innovation: Definition, engineering thinking and learning, distinguish between creativity and innovation. Models of Creative thinking. [Appreciative Inquiry (AI), Asset Based Community Development (ABCD) and Concept of Bricolage.]
Module 4. Process of Social Innovation: Community study, develop questionnaire, identifying the causes of a particular problem.
Module 5. Process of Social Innovation: Identify needs, record your learning's.
Module 6. Process of Social Innovation: Generate ideas, select promising ideas, prototyping, and testing.
Module 7. Social Innovation across Four Sectors - The non-profit sector, public sector, the private sector, the informal sector, links between and cross sectors.

Module 8. Stages of Innovation: Social organizations and enterprises, social movements, social software and opensource methods, common patterns of success and failure.

4. Books and Materials

Text Books:

1. Robin Murray, Julie Caulier-Grice, Geoff Mulgan, "The open book of social innovation: Ways to Design, Develop and Grow Social Innovation", The Young Foundation, 2010.
2. Julie Caulier-Grice, Anna Davies, Robert Patrick & Will Norman, The Young Foundation (2012) Social Innovation Overview: A deliverable of the project: "The theoretical, empirical and policy foundations for building social innovation in Europe" (TEPSIE), European Commission – 7th Framework Programme, Brussels: European Commission, DG Research.

Reference Books/Resources:

1. Geoff Mulgan, "Social Innovation: What it is, Why it matters and How it can be accelerated", The Young Foundation, 2007.
2. Asset Based Community Development (ABCD) Model – http://www.nurturedevelopment.org/asset-based-community-development/
3. Diana Whitney & Amanda Trosten-Bloom, "The Power of Appreciative inquiry – A Practical Guide to Positive Change", 2nd Edition, Berrett-Koehler Publishers, Inc, 2010.

Course Structure
A6022 – Engineering Exploration

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

This Course provides an opportunity for freshman students to learn in new ecosystem and is one of the unique outcomes of innovative education ecosystem in digital era of our nation. The focus of this course is on Engineering Design Process, Problem Solving, Multi-disciplinary skills, Ethics and Data Acquisition and Analysis. This course is co-designed and co-taught by faculty members drawn from multiple engineering disciplines; it follows Project Based Learning (PBL) pedagogy with need statements covering broad themes of environmental, educational, smart appliances, smart agriculture, industrial needs etc. are used by students to carve out problem definitions by linking Sustainable Development Goals defined by United Nation. Students work in teams to solve identified problems and serves as a platform for peer learning and push students in Multi-disciplinary design thinking in first year itself.

Course Pre/co-requisites

The course has no specific prerequisite and corequisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6022.1. Compare and contrast the contributions of different types of engineers in the development of a product, process, or system.

A6022.2. Apply the common engineering design process to solve complex problems and arrive at viable solution.

A6022.3. Explore various contemporary software and hardware tools to provide solutions for the problems.

A6022.4. Apply skills needed for successful teamwork including the basics of project management and written and oral communication.

A6022.5. Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.

3. Course Syllabus

Introduction to Engineering and Engineering Study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer and Graduate Attributes.

Engineering Design Process: Design Cycle, Multidisciplinary facet of design, Importance of analysis in engineering design, general analysis procedure, generation of multiple solution, decision matrix, Concepts of reverse engineering and general mechatronics system.

Introduction to Open-source platforms: Open-source hardware & software tools, Development (Arduino) of Programming (Tinker CAD Tools) and its Essentials, Introduction to Sensors, Transducers and Actuators and its Interfacing with Open-Source H/W & S/W tools.

Engineering Ethics: Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers.
Sustainability: Introduction to sustainability, Sustainability leadership, Life cycle assessment.

Project Management& Tools: Introduction, Significance of teamwork, Importance of communication in engineering profession, Checklist, Timeline, Gantt Chart, Significance of documentation.

4. Laboratory Equipment/Software/Tools Required

1. Open-source Hardware: Microchip ATmega328P (UNO/NANO/MEGA).
2. I/O Peripherals: LCD, Keypad, DC/Servo Motor, Switch, 7-Segment LED modules, GSM, GPS etc.
3. Sensor Tool Kit: Digital RED/WHITE/GREEN/BLUE Light Module, IR, Analog Sound, Soil Moisture, LM35 Analog Linear Temperature, MQ7 Analog Carbon Monoxide etc.
4. Open-source Software: Arduino IDE Version 1.8.5.

5. Books and Materials

Text Book (s)

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, Exploring Engineering: An Introduction to Engineering and Design, Academic Press, 3rd edition, 2012.
2. Byron Francis, Arduino: The Complete Beginner's Guide, Create space Independent Publishers, 2016.
3. M. Govindarajan, S. Natarajan & V. S. Senthil Kumar, Engineering Ethics, 1st Edition, Phi Learning, 2009.

Reference Book (s)

1. Neerparaj Rai, Arduino Projects for Engineers, 1st edition, BPB Publications, 2016.
2. Simon Monk, Programming Arduino: Getting Started with Sketches, 2nd Edition, McGraw-Hill Education, 2016.
3. W. Richard Bowen, Engineering Ethics – Outline of an aspirational approach, Springer London.