Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(*An Autonomous Institute affiliated to University of Pune*)

Structure & Syllabus of

F.E. (Common)

Pattern 'A11'

Effective from Academic Year 2011-12

Prepared by: - Board of Studies in Engineering, Sciences and Humanities

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune.

Signed by,

Chairman – BOS **Chairman – Academic Board**

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@ Please Refer GP-PD-OE Structure & Syllabi Booklet

Program Educational Objectives (PEO)

F.E. (Common)

PEO No.	Description of the Objective
I	**Logical Development:** To develop logical approach and reasoning for understanding, analyzing and designing of engineering applications / to unfamiliar situations
II	**Thought Process:** To promote the process of problem solving abilities, experimental, observational, manipulative, decision making, imagination, visualization and investigatory skills in the learners,
III	**Core Competence:** To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems and also to pursue higher studies.
IV	**Professionalism**: To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate engineering issues to broader social context.
V	**Learning Environment**: To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.

Course Objectives: Course objectives are specified in the course syllabus

2. Program Outcomes,

a. Learners will demonstrate basic knowledge in mathematics, science and engineering.
b. Learners will be familiar with different materials used engineering applications.
c. Learners will demonstrate an ability to design simple mechanical components.
d. Learners will have the confidence to apply engineering solutions in global and societal contexts.
e. Learners will demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results.
f. Learners will demonstrate the ability of engineering drawing that meets desired specifications and requirements.
g. Learners will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.
h. Learners will demonstrate an ability to visualize and work on laboratory and multi-disciplinary tasks.
i. Learners will be familiar with safety, product quality aspects and quality control.
j. Learners will be able to communicate effectively in both verbal and written forms.
k. Learners will be prepared to participate in competitive examinations like GATE, GRE.
l. Learners will be able to understand electrical circuits and its analysis.
m. Learners will be able to demonstrate psychomotor skills for effective use of engineering tools and equipment.
n. Learners will be able to demonstrate understanding of professional, ethical and social responsibilities,
o. Learners will be able to deliver oral presentations and can write well organized accurate reports,
p. Learners will be motivated to engage in to self-learning.

MODULE I

Structure, F.E. (Module I)

FF653, Issue No. 3, Rev 1, dt 02/04/2011

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/week)			Credits
			Lect.	Tutorial	Practical	
S_1	HS10101	Advanced Algebra and Analytical Geometry	3	0	0	3
S_2	HS10103	Modern Physics	3	0	0	3
S_3	CH10101	Chemistry	3	0	0	3
S_4	ME10101	Engineering Graphics	3	0	0	3
T_1	HS10201	Advanced Algebra and Analytical Geometry	0	1	0	1
T_2	HS10203	Modern Physics	0	1	0	1
P_1	CH10301	Science Lab (S2+S3)	0	0	2	1
P_2	ME10301	Engineering Graphics Lab	0	0	2	1
MP_1	HS17401	Mini Project	0	0	2	1
$\#SD_1$	HS14301	Engineering Workshop	0	0	2	1
$**OE_1$	 HS16101 HS16103 HS16105 HS16107	@Elective Course Sociology Psychology Philosophy Environmental Studies	2	0	0	2
		Total	**14**	**2**	**8**	**20**
$\#*GP_1$	HS153XX	International Languages – I	0	0	2	1
$\#\#*GP_2$	HS153XX	International Languages – II	0	0	2	1

The course Engineering Workshop will be offered for both module I and module II in semester I,
** Students have to select and register for only one course from this group,
#* Students will register only one course in Semester I irrespective of Module,
##* Students will register only one course in Semester II irrespective of Module, except course registered in GP 1.

#* GP1	HS15302	French I	##* GP2	HS15301	English I	HS15305	Japanese I	HS15309	Japanese II
	HS15303	German I		HS15302	French I	HS15306	French II	HS15310	English II
	HS15304	Spanish I		HS15303	German I	HS15307	German II		
	HS15305	Japanese I		HS15304	Spanish I	HS15308	Spanish II		

FF No. : 654

HS10101 :: ADVANCED ALGEBRA AND ANALYTICAL GEOMETRY

Credits: 03	**Teaching Scheme: -** Theory 3 Hrs/Week

Prerequisites: Nil

Objectives:

This module I is about the understanding and application of fundamental techniques involved in the analysis of engineering systems. This aims to equip the students with mathematics needed to analyze and solve a range of engineering problems with focus on conceptual understanding.

- To make aware students about the importance and symbiosis between Mathematics and Engineering.
- Achieve a fluency with Mathematical tools which is an essential weapon in modern Graduate Engineer's Armory.
- Balance between the development of understanding and mastering of solution techniques with emphasis being on the development of student's ability to use Mathematics with understanding to solve Engineering problems by retaining the philosophy of **"learning by doing".**
- Mapping with PEOs: I, III V: (a, k, p)

By the end of this module-I students will be expected to demonstrate knowledge of

- Matrix calculation as an elegant and powerful mathematical language in connection with vector spaces, rank of a matrix, linear dependence and independence and linear system of equations.
- Interpretation of the eigen values and eigen vectors of a matrix in terms of the transformation it represents into a matrix eigen value problem.
- Determining a modal matrix from eigen vectors of matrix and spectral matrix from eigenvalues and reducing a matrix to diagonal form. Using matrices to represent transformation between coordinate systems. Definition of quadratic form and determining its nature using eigen value.
- Complex numbers, Argand's diagram, Euler's formula, De Moivre's theorem and their applications.
- Basic concepts of probability theory. Meaning of random variables which in terms form the analysis of certain games of chance and has found applications in most branches of science and engineering. Some standard discrete and continuous distributions viz. Binomial, Poisson, and Normal.
- Determination of the covariance of two random variables and understanding the concept of curve fitting- the principle method of least squares, regression analysis

and the linear correlation coefficient.
- The three co-ordinate systems in the space, recognizing and using quadric surfaces with standard equations.

Unit I
Matrices **(08 Hrs)**

Revision on elementary matrices. Vectors in n-dimension, Vector spaces and subspaces. Linear dependence and independence. Rank of a matrix and solution of Linear Systems. Inner product spaces. Linear transformations, matrices for linear transformations, Transition matrices and similarity and application of linear transformations.

Unit II
Linear Algebra **(08 Hrs)**

Eigen values and Eigen vectors. Cayley-Hamilton theorem and its application. Diagonalization, symmetric matrices and orthogonal diagonalization. Application of eigen values and eigen vectors to rotation of axes (Quadratic forms and reduction of quadratic forms to canonical form).

Unit III
Complex Numbers **(08 Hrs)**

Revision on complex numbers up to Argand Diagram.Polar form of a complex number. De Moivre's theorem and roots of a complex number. Exponential functions of a complex variable. Circular functions of a complex variable. Hyperbolic and inverse hyperbolic functions. Separation of real and imaginary parts of functions of complex variables.

Unit IV
Probability and Statistics **(08 Hrs)**

Random variables, Probability distributions, Mathematical Expectation and variance. Binomial, Poisson, and Normal distributions.

Unit V
Analytical solid Geometry **(08 Hrs)**

Coordinate systems in space. Sphere, Quadric Surfaces. Surface of revolution and Standard surfaces of revolution.

Unit VI
Self Study **(08 Hrs)**

- Orthogonal transformations and its (2-D and 3-D) geometrical interpretation.
- Application of eigen values and eigen vectors to principal axes theorem.
- Logarithm of a complex number.
- Special expansions and indeterminate forms (L'Hospital's rule).
- Equations of Cone, Right circular Cone and Cylinder, Right circular Cylinder with examples.

Note: Five assignments on self study, comprising of one assignment from each unit.

Text Books

1. "Text book of Calculus", Ron Larson and Bruce H. Edwards, Brooke/Cole, a part of Cengage Learning (Indian Edition),
2. "Higher Engineering Mathematics", B.S. Grewal, Khanna Publishers,
3. "Linear Algebra: An Introduction",Ron Larson and David C. Falvo, Brooke/Cole, a part of Cengage Learning (Indian Edition).

Reference Books

1. "Calculus and analytic Geometry", Thomas G. B. and Finney, Wesley / Narosa,
2. "Linear Algebra and its Applications", Gilbert Strang , Cengage Learning (Indian Edition),
3. "Advanced Engineering Mathematics", Michael D. Greenberg, Prentice Hall International publishers.

Additional Reading

1. "Advanced Calculus", Murray R. Spiegel, Schaum's out line series, McGraw Hill International Book Company,
2. "Mathematics for Engineers and Scientists", Alan Jeffrey**,** Champman and Hall/CRC,
3. "Applied Mathematics for Engineers and Physicists", Pipes and Harvill, McGraw-Hill,
4. **"**Advanced Engineering Mathematics", Alan Jeffrey**,** Academic Press,
5. "Advanced Engineering Mathematics", Dennis G. Zill and Michael R. Cullen, Narosa Publishing House,
6. "Linear Algebra and its applications", David C. Lay, Pearson Education, Inc.,
7. "Advanced Engineering Mathematics", C. Ray Wylie, Louis C Barrett R, McGraw-Hill Book Company,
8. "Advanced Modern Engineering Mathematics", James, G, Pearson Education.

FF No. : 654

HS10103 :: MODERN PHYSICS

Credits: 03	**Teaching Scheme: -** Theory 3 Hrs/Week

Prerequisites: Nil

Objectives:

- To understand fundamental principles of modern physics specifically concern to optics and quantum physics and their engineering applications,
- To provide problem solving experience in optics and quantum physics, in both the classroom and the laboratory learning environment,
- To motivate the students through practical examples that demonstrates the role of physics in progress of engineering disciplines so as to inculcate the interdisciplinary academic environment.
- Mapping with PEOs: I, II, III, V : (a, e, h, o, p)

Unit I **(8 + 2 = 10 Hrs)**

[A]

Interference: Coherence, Thin film Interference, Fringe width, Colours in Thin Films (Oil Film, Peacock Feather), Newton's Rings, Michelson's Interferometer, Applications: Wavelength of Light, Resolution of Spectral Lines, Interference Applications: Optically Plane Surface, Antireflection Coatings.

Diffraction: Fresnel and Fraunhofer Diffraction, Fraunhofer Diffraction at Single Slit (Geometrical Method), Conditions for Maxima and Minima, Intensity Pattern, Plane Diffraction Grating (Qualitative Results Only), Dispersive Power of Grating, Resolving Power, Rayleigh's Criterion of Resolution, Resolving Power of Grating and Telescope**,** X - Ray Diffraction from Crystals, Braggs Law.

[B] Self Study

Applications of Newton's Rings for Determination of (i) Radius of Curvature of Plano Convex Lens (ii) Refractive Index of Liquid, Applications of Michelson's Interferometer for Determination of (i) Wavelength of a Monochromatic Source (ii) Refractive Index / Thickness of a Transparent Thin Film, Interference Filters.

Diffraction at Circular Aperture (Results Only), Applications: Resolving Power of Microscope, Wavelength Determination using Grating, Braggs X-ray Spectrometer.

Unit II **(7 + 2 = 9 Hrs)**

[A]

Polarization

Introduction, Malus Law, Double Refraction (Huygen's Theory), Huygen's Construction of Doubly Refracted Wave Fronts for Normal Incidence in Crystal cut with Optic Axis (i) Parallel to Surface, (ii) Inclined to Surface, Retardation Plates**,** Elliptically Polarized Light and its Production, Dichroism, Applications: LCD, Polaroids, Antennas.

Introduction to Special Theory of Relativity

Frames of References, Galilean Relativity, Michelson Morley Experiment (Results only), Physical Event, Lorentz Transformations of Space and Time, Einstein's Formulation of Special relativity, Length Contraction, Time Dilation.

[B] Self Study

Brewster's Law, Geometry of Calcite Crystal, Huygen's Construction of Doubly Refracted Wavefronts for Normal Incidence in Crystal cut with Optic Axis Perpendicular to Surface, Quarter Wave Plate (QWP), Half wave plate (HWP), Nicols Prism, Circularly Polarized Light, Detection of Light (PPL, CPL, EPL, Upl, Par PL).

Relative Velocity, Relativistic Mass and Momentum, Mass and Energy.

Unit III **(9 + 2 = 10 Hrs)**

[A]

Elementary Quantum Mechanics

Limitations of Classical Mechanics and Need of Quantum Mechanics, Wave Particle Duality, Quantum Particle, de-Broglie's Hypothesis, Phase Velocity and Group Velocity, Heisenberg's Uncertainty Principle, Electron Diffraction at Single Slit, Concept of Wave Function (ψ), Max Born's Interpretation of ψ, Physical Significance of ψ and ψ^2.

Quantum Mechanics

Schrödinger's Wave Equations, Applications of Schrodinger's Wave Equations to problems of (i) Particle in Rigid Box (1 D - Infinite Potential Well), Tunneling through a Potential Energy Barrier, Applications of Tunneling Effect, Tunnel Diode.

Nanoscience and Nanotechnology

Introduction, Nanoscience and Nanomaterials, Nanoparticles Properties (Quantum Size Effects: optical, electrical, magnetic, structural, mechanical), Zero, One, Two Dimensional nanostructures, Applications.

[B] Self Study

Rutherford's atomic model, Black body radiation, Photoelectric Effect, Bohr Atom model and its Limitations, Davisson and Germer's Experiment, γ – ray microscope.
Particle in a Non-rigid Box (Finite Potential Well), Qualitative (Results Only), Physical

Interpretation of Quantum Numbers.
Techniques of nanomaterials synthesis (physical, chemical, biological, mechanical, vapour and hybrid methods), Applications of nanotechnology in textile, cosmetics, electronics, energy, automobiles, space, defence, medical, environmental.

Unit IV **(9 + 2 = 10 Hrs)**

[A]

Semiconductor Physics

Kronig-Penny Model (Qualitative), Band Theory of Solids, Energy Bands in C (Graphite, Diamond), Ohm's Law (Microscopic), Temperature Dependence of Conductivity, Hall Effect, Fermi Level, Fermi-Dirac Probability Distribution Function, Fermi Level in Intrinsic (derivation) and Extrinsic Semiconductors (Effect of Temperature and Doping Level on Fermi Energy), Working of PN Junction Diode from Energy Band Diagrams, Photovoltaic Effect, Solar Cell Working and Characteristics.

Superconductivity

Introduction, Properties of Superconductors (Zero Resistance, Meissner Effect, Critical Fields, Persistent Currents, Critical Current Density, London Penetration Depth, Isotope Effect), BCS Theory, Preparation of High Tc Superconductors, DC and AC Josephson Effect, Superconducting Quantum Interference Devices (SQUID), Applications.

[B] Self Study

Hybridization, Energy Bands in Li, Be, Na, Si, Valence Band, Conduction Band, Forbidden Gap, Classification of Solids into Conductors, Semiconductors and Insulators, Electrical Conductivity of Conductors and Semiconductors, PNP and NPN Transistors, Applications of Solar Cell.
Type I and II Superconductors, High Tc Superconductors, Applications: Transmission Lines, Superconducting Magnets, Maglev Trains, Magnetic Resonance Imaging (MRI Scanning), Superconductors in Computing.

Unit V **(7 + 2 = 9 Hrs)**

[A]

Lasers and Applications

Stimulated Absorption, Spontaneous and Stimulated Emission, Population Inversion, Basic Requirements for Lasing Action, Laser Properties, He-Ne Laser, Semiconductor Diode Laser, Carbon Dioxide Laser (Principle, Construction and Working).

Nuclear Physics

Binding Energy Curve, Nuclear Fission, Q - value of Nuclear Reaction, Nuclear Magnetic Resonance (NMR), Applications, Nuclear Fusion, Controlled Fusion, Ignition Temperature, Fusion Reactors, Confinement Schemes: Gravitational, Magnetic, Inertial, Laser Fusion Reactor.

[B] Self Study

Ruby Laser, Applications of Lasers (Industry : Drilling, Welding and Micromachining, Medical: Laser Eye, Skin, Cosmetic Surgery, Communication: Fibre Optics, Military Applications: Laser range detection, Laser Guided Missiles)

Nuclear constituents, Atomic Mass Unit, Mass Defect and Packing Fraction, Binding Energy, Uranium Chain reaction, Distinction between Nuclear Fission and Fusion, Fusion: Future Source of Energy, Fusion reactions.

Note: Five assignments on self study, comprising of one assignment from each unit.

Text Books

1. "Engineering Physics", Hitendra K. Malik & A. K. Singh, Tata McGraw Hill, New Delhi, 2010,
2. "Physics for Scientists and Engineers with Modern Physics", Raymond J. Serway & John W. Jewett, Seventh Edition, Thomson / Cengage Learning, New Delhi, 2010,
3. "Concepts of Modern Physics", Beiser Arthur, (6th) New, Tata McGraw Hill Pub. Co, 2005.

Reference Books

1. "University Physics with Modern Physics", Young and Freedman – 12th Ed. (Pearson Education),
2. "Lectures on Physics", Volume 1, 2 and 3 by Richard P. Feynman, Narosa Publisers / Pearson Education.

Additional Readings

1. "Fundamentals of Optics", Jenkins & White, M Hill Book Co, 1983,
2. "Fundamentals of Physics", Resnick and Halliday, John Wiley and Sons.

FF No. : 654

CH10101 :: CHEMISTRY

Credits: 03	**Teaching Scheme: -** Theory 3 Hrs/Week

Prerequisites: Nil.

Objectives:

- To develop analytical ability amongst students.
- To impart pure chemistry principles.
- To understand the chemistry behind development of fundamentals.
- Mapping with PEOs: II, III, V : (a, b, e, h, o, p)

Unit I **(9+2 Hrs)**

[A]

Chemical Bonding and Co-ordination Chemistry

Types of Bonds, Valance Bond Theory, Concept of Hybridization, Molecular Orbital Theory, MO Diagrams for Homogeneous and Heterogeneous molecules, Interpretation of Bond Order and Magnetic properties of molecules. Types of ligands, Nomenclature of Co-ordination complexes, Isomerism in Co-ordination complexes. Theories of Co-ordination compounds (VBT and CFT).

[B] Self Study: M.O. Diagram for N_2 and NO, Calculation of bond order and magnetism,

Unit II **(9+1 Hrs)**

[A]

Molecular Spectroscopy

Absorption Laws, Principle, Instrumentation and applications of UV-Visible, IR and NMR Spectroscopy, Woodward- Fieser Rule for calculating λ max. General idea of Mass spectroscopy, Numerical on all the three types of spectroscopy.

[B] Self Study: Additional numerical on UV-visible, IR and NMR spectroscopy.

Unit III **(8+2 Hrs)**

[A]

Thermodynamics

Basic terms in Thermodynamics, First law of thermodynamics, concept of enthalpy, Limitations, Second law of thermodynamics, Clausius and Kelvin statement, Concept of Entropy, Change in entropy for isothermal, reversible and irreversible process. Free energy, Physical significance and application of Gibbs-Helmholtz equation, Vant Hoff's Isotherm and Isochore. Numerical.

[B] Self Study: Numericals on first law of thermodynamics, entropy and enthalpy.

Unit IV **(7+1 Hrs)**

[A]

Chemical Kinetics

Rate of reaction, experimental determination, Rate law and rate constant, Order and molecularity of reaction, Integrated rate equation for first and second order kinetics, Half life for first and second order kinetics, Arrhenius equation, Numericals on activation energy, Half life, rate constant for first and second order kinetics.

[B] Self Study: Characteristics of rate constant, comparison between rate of reaction and rate constant, comparison between order and molecularity of reaction.

Unit V **(7+2 Hrs)**

[A]

Structure and Reactivity of Organic Molecules

Explanation and application of inductive, electromeric, mesomeric and hyperconjugative effect, Structure and stability of carbocation, carbanian, and free radical, Types of organic reactions (Substitution, Addition and Elimination), Optical isomerism, Geometrical isomerism, Conformational analysis of ethane.

[B] Self Study: Types of Bond cleavage, study of named reactions.

Note: Five assignments on self study, comprising of one assignment from each unit.

Text Books

1. "Engineering Chemistry", Dr. B. S. Chauhan, University Science Press, New Delhi, 3rd edition,
2. "Engineering Chemistry", Jain and Jain, Dhanpat Rai Publication.

Reference Books

1. "Principle of Physical Chemistry", B.R. Puri, L.R. Sharma, M.S. Pathania, S. Chand and Co. Ltd., New Delhi,
2. "Organic Chemistry- Vol 1", I L Finar, Pearson, 6th Edition,
3. "Selected Topics in Inorganic Chemistry" W. U. Malik, G. D. Tuli, R. D. Madan S. Chand and Co. Ltd., New Delhi.

FF No. : 654

ME10101 :: ENGINEERING GRAPHICS

Credits: 03	**Teaching Scheme: -** Theory 3 Hrs/Week

Prerequisites: Nil

Objectives:

- To develop 3 dimensional imagination
- To learn basic concepts of Lines, planes and solids.
- To visualize the basic principles of orthographic and isometric projections.
- Mapping with PEOs: I, II, III, V : (c, e, f, h, p)

Unit I **(8 Hrs)**

Engineering Curves
Ellipse, Parabola, Hyperbola, normal and tangents to these curves, Involute, Cycloid, Epi-cycloid, Hypo-cycloid, Archimedean Spiral, Helix on cone and cylinder.

Lines and Dimensioning in Engineering Drawing
Different types of lines used in drawing practice, Dimensioning – linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

Orthographic Projections
Reference planes, Use of First angle and Third angle projection method

Unit II **(8 Hrs)**

Projections of Points and Lines and planes
Projections of points, projections of lines, lines inclined to one reference plane, Lines inclined to both reference planes. (Lines in First Quadrant Only) Traces of lines, Projections of Planes, Angle between two planes, Distance of a point from a given plane, Inclination of the plane with HP, VP

Unit III **(8 Hrs)**

Projections of Solids and Sections of Solids
Projections of solids inclined to one reference plane, inclined to both the Reference Planes. Projections of cube, right regular prisms, right regular pyramids, right circular cylinder. Types of section planes, projections of above solids cut by different section

planes, True shape of cut surfaces.

Unit IV **(08 Hrs)**

Interpenetration of solids and Development of Lateral Surfaces (DLS) of Solids
Interpenetration of solids, cylinder, cone, prism, pyramid, Development of Lateral Surfaces (DLS) of Solids, Applications of DLS, method of development, development of lateral surface of above solids**.**

Unit V **(08 Hrs)**

Isometric Projections
Isometric view, construction of Isometric view from given orthographic views (for simple engineering objects) Isometric view of a Pyramid, Cone.

Unit VI **(05 Hrs)**

Self Study
- Sectional orthographic projections – full section,
- Distance between skew lines, True shape of a plane surface,
- Frustum of right circular cylinder and cone,
- Antidevelopment of lateral surface of cut solids,
- Isometric view of a Sphere

Note: Five assignments on self study, comprising of one assignment from each unit.

Text Books

1. "Elementary Engineering Drawing", N.D. Bhatt, Charotar Publishing house, Anand India,
2. "Text Book on Engineering Drawing", K.L.Narayana & P.Kannaiah, Scitech Publications, Chennai.

Reference Books

1. "Fundamentals of Engineering Drawing", Warren J. Luzzader, Prentice Hall of India, New Delhi ,
2. "Engineering Drawing and Graphics", Venugopal K., New Age International Publishers.

FF No. : 654

HS10201 :: ADVANCED ALGEBRA AND ANALYTICAL GEOMETRY (Tutorial)

Credits: 01	**Teaching Scheme:** Tutorial 1 Hr/Week

Prerequisites: Nil.

Objectives:

Module I is a full one semester course taken by all junior freshmen engineering students. It starts with matrix, linear algebra, complex numbers, solid geometry and calculus of functions of one variable. The module I emphasize both theoretical foundations of calculus, linear algebra, complex number, solid geometry self study and their applications. It is intended to enable students to recognize mathematical structures in practical problems, to translate problems into mathematical language and to apply 'Engineering Mathematics I' to solve them as well as real world problems.

Upon completion of this module students will be able to:

- Recognize mathematical structures in practical problems.
- Translate problems into mathematical language and analyze problems using methods from all the units.
- Mapping with PEOs: I, III, V : (a, k, p)

List of Contents

In this module I students will work on problems to practice and apply methods introduced in the theory lectures. Discussions of problems in small groups is always encouraged and facilitated and students are asked to submit weekly home work assignments and provide them immediate feedback and support materials.

Tutorial No. 1: Summary on matrices, vectors in n-dimensions, vector spaces and subspaces, linear dependence and independence and problems solving.

Tutorial No. 2: Summary on rank of a matrix, solution of linear systems, inner product spaces and problems solving.

Tutorial No. 3: Summary on linear transformations, matrices for linear transformations, transition matrices and similarity and application of linear transformations and problems solving.

Tutorial No. 4:	Summary on Eigen values and eigen vectors, Cayley-Hamilton theorem and its application, diagonalization, symmetric matrices and orthogonal diagonalization and problems solving.
Tutorial No. 5	Summary on application of eigen values and eigen vectors to rotation of axis (quadratic forms and reduction of quadratic forms to canonical forms) and problems solving.
Tutorial No. 6:	Summary on complex numbers upto Argand diagram, polar form of a complex number, De Moivre's theorem roots of complex numbers and problems solving.
Tutorial No. 7:	Summary on exponential and circular functions of complex variables, hyperbolic and inverse hyperbolic functions, separation of real and imaginary parts of functions of complex variables and problems solving.
Tutorial No. 8:	Summery on random variable, probability distribution, mathematical expectation, variance and problems solving.
Tutorial No. 9:	Summery on curve fitting – the method of least squares, regression, linear correlation coefficient and problems solving.
Tutorial No. 10:	Problem solving sessions on standard probability distributions
Tutorial No. 11:	Summary on co-ordinate systems in space and sphere and problems solving.
Tutorial No. 12:	Summary on quadratic surfaces, surface of revolution and standard surfaces of revolution and problems solving.

Text Books

1. "Text book of Calculus", Ron Larson and Bruce H. Edwards, Brooke/Cole, a part of Cengage Learning (Indian Edition),
2. "Higher Engineering Mathematics", B.S. Grewal, Khanna Publishers,
3. "Linear Algebra: An Introduction",Ron Larson and David C. Falvo, Brooke/Cole, a part of Cengage Learning (Indian Edition).

Reference Books

1. "Calculus and analytic Geometry", Thomas G. B. and Finney, Wesley / Narosa,
2. "Linear Algebra and its Applications", Gilbert Strang , Cengage Learning (Indian Edition),
3. "Advanced Engineering Mathematics", Michael D. Greenberg, Prentice Hall International publishers.

Additional Reading

1. "Advanced Calculus", Murray R. Spiegel, Schaum's out line series, McGraw Hill International Book Co.,
2. "Mathematics for Engineers and Scientists", Alan Jeffrey**,** Champman and Hall/CRC.
3. "Applied Mathematics for Engineers and Physicists", Pipes and Harvill, McGraw-Hill,
4. **"**Advanced Engineering Mathematics", Alan Jeffrey**,** Academic Press,
5. "Advanced Engineering Mathematics", Dennis G. Zill and Michael R. Cullen, Narosa Publishing House,
6. "Linear Algebra and its applications", David C. Lay, Pearson Education, Inc.,
7. "Advanced Engineering Mathematics", C. Ray Wylie, Louis C Barrett R, McGraw-Hill Book Company,
8. "Advanced Modern Engineering Mathematics", James, G, Pearson Education.

FF No. : 654

HS10203 :: MODERN PHYSICS (Tutorial)

Credits: 01	**Teaching Scheme: -** 1 Hr/Week

Prerequisites: : Nil

Objectives:

- To understand fundamental principles of modern physics specifically concern to optics and quantum physics and their engineering applications,
- To provide problem solving experience in optics and quantum physics, in both the classroom and the laboratory learning environment,
- To motivate the students through practical examples that demonstrates the role of physics in progress of engineering disciplines so as to inculcate the interdisciplinary academic environment.
- Mapping with PEOs: I, II, III, V : (a, e, h, o, p)

List of Contents

In this module students will work on problems to practice and apply methods introduced in the theory lectures. Discussions of problems in small groups is always encouraged and facilitated and students are asked to submit weekly home work assignments and provide them immediate feedback and support materials.

Tutorial No. 1: Introduction to Waves, Superposition Principle, Phase Difference, Coherence,

Tutorial No. 2: Methods of production of Coherent Sources, Division of Amplitude, Division of Wavefront, Interference, Introduction to Diffraction,

Tutorial No. 3: Problems on Thin Film Interference, Fringe Width,

Tutorial No. 4: Problems on Newton's Ring Experiment, Problems on Michelson's Interferometer, Antireflection Coatings, Interference Filter

Tutorial No. 5 Problems on Diffraction due to Single Slit, Problems on Diffraction Grating,

Tutorial No. 6: Problems on Resolving Power of Grating, Telescope and Microscope,

Tutorial No. 7: Problems on Polarization, Malus Law, Brewster's Law, Retardation Plate etc.

Tutorial No. 8: Problems on Special Theory of Relativity: Length Contraction, Time Dilation, Relative Mass etc.

Tutorial No. 9: Problems on de-Broglies Hypothesis, Davisson & Germer Experiment,

Tutorial No. 10: Problems on Heisenberg's Uncertainty Principle, Problems on Normalization and 1 D – Infinite Potential Well,

Tutorial No. 11: Problems on Superconductivity: Critical Field, Isotope Effect, Penetration Depth,

Tutorial No. 12: Problems on Conductivity, Hall Effect, Problems on Nuclear Physics,

Text Books

1. "Engineering Physics", Hitendra K. Malik & A. K. Singh, Tata McGraw Hill, New Delhi, 2010,
2. "Physics for Scientists and Engineers with Modern Physics", Raymond J. Serway & John W. Jewett, Seventh Edition, Thomson / Cengage Learning, New Delhi, 2010,
3. "Concepts of Modern Physics", Beiser Arthur, (6th) New, Tata McGraw Hill Pub. Co, 2005.

Reference Books

1. "University Physics with Modern Physics", Young and Freedman – 12th Ed. (Pearson Education),
2. "Lectures on Physics", Volume 1, 2 and 3 by Richard P. Feynman, Narosa Publisers / Pearson Education.

FF No. : 654

CH10301 :: SCIENCE LABORATORY (S_2 + S_3)

Credits: 1	**Teaching Scheme: -** Laboratory 2 Hrs/Week

Prerequisites: Nil

Objectives:

S_2 : MODERN PHYSICS LABORATORY

- To understand and experience the basics of physics through expert member.
- To learn the proper methods and techniques utilized in gathering experimental data.
- To become familiar with the proper use of basic measuring instruments commonly found in physics laboratory.
- To develop the ability to recognize and apply the appropriate physics introduced in the lecture course to actual experimental situations by taking mini projects.
- To learn how to analyse data and then reach scientific conclusions based on analysis.
- Mapping with PEOs: I, II, III, IV, V : (a, e, h, g, j, o, p)

List of Practical (Experiments to be performed as per following code of conduct)

Sr. No.	**Name of the Experiment**	**Mode of Conduct**
1.	Newton's rings experiment (Wavelength, radius, refractive index)	**Experiment no 1:** Any one of two to be performed by students and other for demonstration of working principle.
2.	Michelson's Interferometer.	
3.	To verify cosine square law of Malus for plane polarized light using photocell.	**Experiment no 2:** Any one of four to be performed by the students and any two of remaining for demonstration of working principle.
4.	Determination of Brewster's angle for glass surface and refractive index of glass.	
5.	Determination of refractive indices for ordinary, extraordinary rays for a quartz crystal / Prism.	
6.	Demonstration of Lissajous figures using a CRO (Principle of interference) concepts of polarization	
7.	Use of diffraction grating for the determination of wavelength of spectral line.	**Experiment no 3:** Any one of four to be performed by the students and any two of remaining for demonstration
8.	Determination of thickness of wire using LASER.	
9.	Determination of wavelength of a given laser source.	

10.	Resolving power of a telescope / Grating.	of working principle.
11.	Determination of band gap of a semiconductor.	**Experiment no 4 and 5:** Any two of five to be performed by the students and any two of remaining for demonstration of working principle.
12.	Characteristics of solar cell, calculation of fill factor.	
13.	Hall Effect, determination of Hall coefficient.	
14.	Study of diode characteristics (PN, Zener, Tunnel)	
15.	Characteristics of a photocell.	

Text Books

1. "Engineering Physics", Hitendra K. Malik & A. K. Singh, Tata McGraw Hill, New Delhi, 2010,
2. "Physics for Scientists and Engineers with Modern Physics", Raymond J. Serway & John W. Jewett, Seventh Edition, Thomson / Cengage Learning, New Delhi, 2010.
3. "Concepts of Modern Physics", Beiser Arthur, (6th) New, Tata McGraw Hill Pub. Co, 2005.

Reference Books

1. "University Physics with Modern Physics", Young and Freedman – 12th Ed. (Pearson Education),
2. "Lectures on Physics", Volume 1, 2 and 3 by Richard P. Feynman, Narosa Publisers / Pearson Education.

Objectives:

S_3 : CHEMISTRY LABORATORY

- To develop an analytical ability
- To integrate chemistry fundamentals with practical applications.
- To understand the chemistry behind physico-chemical phenomena.
- Mapping with PEOs: II, III, V : (a, b, e, h, j, o, p)

List of Practical (any five):

1. Experimental verification of Beer-Lambert's law by determining unknown concentration of solution of ferric ammonium sulphate using colorimeter.
2. To find out the heat of neutralization of sodium hydroxide and hydrochloric acid.
3. To determine the value of rate constant (k) for the hydrolysis of ethyl acetate catalyzed by hydrochloric acid.
4. Preparation of acetanilide from aniline.
5. Preparation of benzoic acid from ethyl benzoate.
6. Preparation of *tris*- (ethylenediamine) nickel thiosulphate.

Text Books

1. "Lab manual on Engineering chemistry", Dr. S Rani, Dhanpat Rai Publication,
2. "Applied Chemistry Theory and Practical", O P Virmani and A K Narola New Age International Publication.

Reference Books

1. "Practical Inorganic Chemistry", Vogel, Prentice Hall Publication,
2. "Practical Organic Chemistry", Vogel, Prentice Hall Publication.

FF No. : 654

ME 10301 :: ENGINEERING GRAPHICS LABORATORY

Credits: 1	**Teaching Scheme: -** Laboratory 2 Hrs/Week

Prerequisites: Nil

Objectives:

- To develop 3 dimensional imagination,
- To learn basic concepts of Lines, planes and solids,
- To visualize the basic principles of orthographic and isometric projections.
- Mapping with PEOs: I, II, III, V : (c, e, f, h, j, p)

Term Work should be prepared on Six A2 (594 × 420mm) (Half imperial) size drawing sheets as detailed below:

List of Practicals

1. Lines, lettering and dimensioning	(2 weeks)
2. Orthographic Projections (2 problem)	(3 weeks)
3. Projection of Line and Planes (Each 1 problem)	(2 weeks)
4. Projections of Solids and Sections of Solids (Each 1 problem)	(2 weeks)
5. Interpenetration of solids and DLS of Solids (Each 1 problem)	(3 weeks)
6. Isometric Projections (2 problem)	(2 weeks)

Text Books

1. "Elementary Engineering Drawing", N.D. Bhatt, Charotar Publishing house, Anand India,
2. "Text Book on Engineering Drawing", K.L.Narayana and P.Kannaiah, Scitech Publications, Chennai.

Reference Books

1. "Fundamentals of Engineering Drawing", Warren J. Luzzader, Prentice Hall of India, New Delhi,
2. "Engineering Drawing", Venugopal K., New Age International Publishers.

FF No. : 654

HS 14301 :: ENGINEERING WORKSHOP

Credits: 1	**Teaching Scheme: -** Laboratory 2 Hrs/Week

Prerequisites: Nil

Objectives:

- To give students 'hands on experience' of craftsmanship
- To make students familiar with different work trades
- To develop quality and safety consciousness amongst the students
- To develop awareness of fire safety amongst the students
- To develop respect towards labor work amongst the students.
- Mapping with PEOs: I, II, IV, V : (b, c, f, g, i, j, m)

Practical Details:

1. Carpentry

Introduction, use of marking tools and hand tools such as marking gauge, try squares, steel rules, saws, jackplane, chisels, etc. Use of power tools, safety precautions.

Practical

One job involving different operations such as sawing, planning, chiseling, etc.

2. Welding

Introduction, principle of manual metal arc welding, equipment and it's operation, welding electrodes, welding joints, welding symbols, safety precautions.

Practical

One job on mild steel.

3. Mini Project

Besides the above jobs, students in groups will make an article / gadget / model / setup involving the work of above work trades and / or other work trades.

Demonstrations

1. Fire Safety

Introduction, fire prevention precautions, necessity of fire fighting, fire extinguishers, rules of fire fighting, risk elements in fire fighting and demonstration of use of fire extinguishers.

2. Gas Cutting

Introduction, principle, equipment and it's operation, safety precautions and demonstration of Oxy-Acetylene Gas cutting process.

Note:- Students should wear safety apron and safety shoes during the practicals.

Text Books

1. S. K. Hajra Choudhary, Elements of Workshop Technology, Media Promoters and Publishers Pvt. Ltd.,
2. K.T. Kulkarni, Introduction to Industrial Safety, K.T. Kulkarni, Pune.

Reference Books

1. Hwaiyu Geng, Manufacturing Engineering Handbook, McGraw Hill Publishing Co. Ltd.,
2. Lawrence E. Doyle, Manufacturing Processes and Materials for Engineering, Prentice Hall Inc.

ACADEMIC INFORMATION

A) Mid Semester Examination

1. Students reporting in morning slot will have examination in morning slot. Those in evening slot will have examination in evening slot.
2. 20 multiple choice based questions to be attempted in 30 minutes x no. of theory courses i.e. 100 questions in 150 minutes for F.E., 80 questions in 120 minutes for S.E., T.E.,B.E.,M.E., 20 questions in 30 minutes for Honors, Minor, Fast Track, etc.
3. A scrambled mix of questions will be generated through software.
4. Mid Semester Examination will be based on Unit II & Unit III.
5. There will be one mark for each correct answer and (-) 0.25 marks for every wrong answer.
6. For a typical 3 hour Mid Semester Examination, first 15 minutes would be used for student attendance, record keeping, seat allocation, log in procedure if any, etc. Next 150 minutes for actual examination. A timer indicating time remaining to be provided by ERP. 15 minutes for processing & results.
7. A visual alarm / flash would be given 10 minutes before completion of 150 minutes as a warning. For auto generation of every theory course result out of 20 and dispatch of the marks on student mobile and mail ID as well as parent mail ID.
8. No repeat examination under any circumstances.

B) Seminar – Conduct, Evaluation, etc.

Seminar– (T.E.- Semester I)

1. Review – I: during Mid Semester Examination (Compulsory) as per the Academic Calendar.
2. Review – II : The last week of November (Optional)
3. For poor performing students identified by the examination panel, a second review to be taken. Review II optional for other students. For Review II, deduction of 10 marks will take place.
4. Seminar is an individual activity with separate topic and presentation.
5. Duration of presentation – 20 minutes
   Question and answer session – 10 minutes

Seminar Evaluation Scheme :

1.	Attendance during Semester	– 10 marks
2.	Attendance during Seminar presentation self & peer	– 10 marks
3.	Relevance of Seminar topic	– 10 marks
4.	Timely Abstract submission	– 10 marks
5.	Literature review	– 10 marks
6.	Technical contents	– 10 marks
7.	Presentation	– 25 marks
8.	Question & answer Session	– 15 marks
		---
		100 marks
		=========

C) Equivalence

For the courses belonging to 2008 structure counseling sessions for failure students will be arranged. The Head of Department will appoint faculty identified as subject experts as counselors. The previous examination scheme i.e.

Class Test – 10 marks
T.A. through Home assignment – 10 marks
A written paper MSE – 30 marks
A written paper ESE – 50 marks

Will be followed. The entire processing based on 2008 structure related coding scheme will be followed. Counseling + Administration + Examination charges will be the basis for fees considered for such students.

D) Extra Credits

A student planning to take extra credits may be considered under following categories :

(a) A student carrying a backlog and re-registering for the previous course – Re-registration charges as applicable. Consideration of all courses registered for during that Semester of Academic Year for SPI calculation.

(b) Student planning to take extra courses as a fast track opportunity – Administration, processing and examination charges will be considered. In any case the student has to pay the college fees for four years. This fast track facility would enable the student to undergo an industrial training, an exchange programme, research contribution in I.I.T. under scheme such as KVPY without any academic compromises for credit transfer. The phasewise development and completion of project activity cannot be considered at an accelerated pace under fast track scheme. The registration under fast track is subject to having a CPI 8.0 or above and no backlog for consideration of registration to an additional course.

(c) Students opting for earning extra credits by selection of courses in addition to the courses prescribed by respective BOS which are single Semester activities and not the part of Honors / Minor scheme. Such students will be expected to pay charges equivalent to re-registration (proportionate credit based payment). The registration for such courses is subject to permission given by the Chairman BOS of the Board in the purview of which the subject is identified. Such permissions will be given based on meeting with prerequisite subject.

1. In any case (a), (b) or (c) the candidate cannot register for more than 8 credits.
2. A suitable reflection of completion of the said course will be made in the candidate's Grade statement.

For part (c) a separate grade & GPA will be calculated. That GPA will not be clubbed with the other regular courses for SPI, CPI calculation.

E) Home Assignment

A Home Assignment Calendar for Semester is prepared as under:

Week No.	Activity
1	No Home Assignments
2	No Home Assignments
3	No Home Assignments
4	S1 / S2 – HA1
5	S3 / S4 / S5* - HA1
6	S1 / S2 – HA2
7	S3 / S4 / S5* - HA2
8	S1 / S2 – HA3
9	S3 / S4 / S5* - HA3
10	S1 / S2 – HA4
11	S3 / S4 / S5* - HA4
12	S1 / S2 – HA5
13	S3 / S4 / S5* - HA5
14	No Home Assignments
15	No Home Assignments
16	No Home Assignments

The Home Assignments will be based on the self study component i.e. part B of every theory course syllabus. The Saturday or last working day will be the default deadline for submission of Home Assignment of that week. For example by the Saturday ending Week No. 9, Home Assignment No. 3 for subject S3/ S4/ S5 (if applicable) must be submitted.

1. *S5 can be OE1 / OE2 / OE3 / Honors/ Minor / Re-registration category (a) / Category (b) / Category (c).
2. For subjects S1, S2, S3, S4 & S5 (if any), the composition of the Teacher Assessment marks will be as follows :

	S1,S2 with Tutorial	**S3,S4,S5 without Tutorial**
Home Assignment	30 marks	30 marks
Tutorial	30 marks	
Test	30 marks	30 marks
Attendance : (a) > 90% (b) 75% to 90% (c) <75%	 10 marks 5 marks 0 marks	 10 marks 5 marks 0 marks
	100 marks converted to 15 marks	70 marks converted to 15 marks

Explanation :

1. Tutorials to be conducted with continuous assessment throughout the Semester. Final assessment out of 30 marks for Tutorial.
2. Class Test to be conducted during a regular theory class within the time period mentioned in the Academic Calendar.
3. Class Test marks are to be entered immediately as mentioned in Academic Calendar.
4. Attendance percentage to be calculated at the end of Semester after completing all lectures as per the lesson plan.

F) Mini Project

Teaching Scheme: Theory – 0 ; Tutorial – 0 ; Laboratory – 2 Hrs / week

For F.E., S.E. & T.E. students in every Semester a Mini Project be carried out. The objectives behind the Mini Project are:

1. Scope for creativity
2. Hands on experience
3. Academic occupancy

Mini Project will be based on all subjects of that Semester except GP.

1. The Semester Mini Project will be for a group of 3 to 5 students. Head of Department to appoint Mini Project Guides. 1 credit will be awarded to the candidate after the viva voce and project demonstration at the End of Semester.
2. Group formation, discussion with faculty advisor, formation of the Semester Mini Project statement, resource requirement, if any should be carried out in the earlier part of the Semester. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.

   The Assessment Scheme will be:

   (a) Continuous Assessment 50 marks

   (b) End Semester 50 marks

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   100 marks

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G) Project Stage I Evaluation

The project activity is broken in 3 stages:

The Project Stage I will be in T.E Semester II irrespective of student module. The evaluation of Project Stage I will be as follows:

Group formation & attendance / reporting to guide	20 marks
Topic finalization / Statement	20 marks
Literature Survey	20 marks
Abstract	20 marks
Presentation	20 marks

Project Stage II and Project Stage III evaluations will be based on Department specific norms.

H) Composition for Selection of 5 Credits for Honors / Minor Course (Applicable for B_{11} and A_{11} Patterns)

(A) Comprehensive Viva Voce – Compulsory at the end of Semester VIII – 1 Credit

(B) Elective Component

a. Laboratory courses – Maximum Credits - 2

(for award of 1 Credit the lab course would have a teaching scheme of 2 Hrs. / week and a plan of 12 practicals). The credit to be awarded as per the ISA and ESA guidelines for the compulsory lab courses.

b. Research publication – Maximum Credits – 1

(Research Publication in a Magazine / Transaction / Journal as decided by the honors / minor co-ordinator)

c. Seminar - Maximum Credits – 1

(Seminar to be given on a topic consistent with the scope of the Honors or Minor. The topic Selection is to be approved by the honors / minor co-ordinator. The assessment and evaluation scheme would as per the guidelines used for Technical Seminar at UG level by respective Dept.)

d. Honors / Minors Project – Maximum Credits – 2

(Project Topic and Scope, its progress and final assessment consistent with the scope of the Honors or Minor. The topic Selection is to be approved by the honors / minor co-ordinator. The assessment would as per the guidelines and evaluation scheme used for Project Work at UG level by respective Dept.)

e. Industrial Training – Maximum credits – 4

(An Industrial Training in an Industry identified by the student, approved by the honors / minor co-ordinator & Head of Department. The assessment would as per the guidelines and evaluation scheme used for Industrial Training at UG level by respective Dept.)

Note :

a. 4 Credits would be awarded to the students for a complete 12 Week Industrial Training and meeting with the assessment and evaluation requirements

b. Provision can be made for the students unable to procure a 12 week Industrial Training. A 4 week or 8 week Industrial Training may also be offered. 2 credits will be awarded for 8 week Industrial Training and 1 Credit would be awarded to the students for a 4 Week Industrial Training, meeting with the assessment and evaluation requirements

c. No Industrial Training less than 4 weeks be considered for award of 1 Credit

d. No cumulative addition of Industrial Training period would be considered for award of credits

The student is expected to earn 1 Credit from Part (A) and remaining 4 Credits from Part (B)