

# Applied Science Department

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## Subject offered by the Department

S.N.	Paper Code	Subject	Prerequisite subject	L	T	P	Credits
		<b>Under Graduate Programme</b>					
		<b>Year-I</b>	-				
1.	BAS-01	Engineering Mathematics-I	-	3	1	0	4
2.	BAS-02	Engineering Physics-I	-	3	1	2	5
3.	BAS-03	Professional Communication	-	3	1	0	4
4.	BAS-04	Environmental Chemistry	-	3	1	0	4
5.	BAS-05	Environment & Ecology	-	2	1	0	3
6.	BAS-06	Space Science	-	2	1	0	3
7.	BAS-07	Engineering Mathematics-II	-	3	1	0	4
8.	BAS-08	Engineering Physics-II	-	3	1	2	5
9.	BAS-09	Engineering Chemistry	-	3	1	2	5
10.	BAS-10	Technical Writing	-	2	1	0	3
11.	BAS-11	Human Values & Professional Ethics	-	2	1	0	3
12.	BAS-12	Industrial Psychology	-	2	1	0	3
13.	BAS-13	Industrial Sociology	-	2	1	0	3
14.	BAS-14	Graph Theory	-	3	1	2	5
15.	BAS-15	Applied Engineering Chemistry	-	3	1	2	5
		<b>Year-II</b>					
16.	BAS-20	Communication Skills	-	0	0	4	2
17.	BAS-21	Engineering Mathematics-III	-	3	1	0	4
18.	BAS-22	Nanotechnology	-	2	1	0	3
19.	BAS-23	Engineering Mathematics-IV	-	3	1	0	4
20.	BAS-24	Applied Computational Methods	-	3	1	2	5
21.	BAS-25	Probability Theory & Stochastic Process	-	3	1	0	4
22.	BAS-26	Optimization Techniques	-	3	1	0	4
23.	BAS-27	Discrete Mathematics	-	3	1	0	4
24.	BAS-28	Solid State Physics	-	3	1	2	5
25.	BAS-29	Numerical Methods	-	3	1	2	5
26.	BAS-31	Advanced Mathematics & Statistics	-	3	1	0	4
27.	MAS-109	Foreign Language-French	-	2	1	0	3
28.	MAS-109	Foreign Language-German	-	2	1	0	3
29.	MAS-109	Foreign Language-Spanish	-	2	1	0	3

## SYLLABI

### BAS-01 ENGINEERING MATHEMATICS-I

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 4
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory

Examination  
**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of basic differential operators in various engineering problems.
2. Solve linear system of equations using matrix algebra.
3. Use vectors to solve problems involving force, velocity, work and real life problems and able to analyze vectors in space
4. Evaluate and use double integral to find area of a plane region and use of triple integral to find the volume of region in 3<sup>rd</sup> dimension

### Topics Covered

#### UNIT-I

**Differential Calculus:** Leibnitz theorem, Partial derivatives, Euler's theorem for homogenous function, Total derivative, Change of variable. Taylor's and Maclaurin's theorem. Expansion of function of two variables, Jacobian, Extrema of function of several variables. 9

#### UNIT-II

**Linear Algebra:** Rank of Matrix, Inverse of a Matrix, Elementary transformation, Consistency of linear system of equations and their solution. Characteristic equation, Eigen-values, Eigen-vectors, Cayley-Hamilton theorem. 9

#### UNIT-III

**Multiple Integrals:** Double and triple integrals, change of order of integration, change of variables. Application of multiple integral to surface area and volume. Beta and Gamma functions, Dirichlet integral. 9

#### UNIT-IV

**Vector Calculus:** Gradient, Divergence and Curl. Directional derivatives, line, surface and volume integrals. Applications of Green's, Stoke's and Gauss divergence theorems (without Proofs). 9

### Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers.
2. B.V. Ramana: Higher Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. H.K. Dass and Rama Verma: Engineering Mathematics; S. Chand Publications.
4. N.P. Bali and Manish Goel: Engineering Mathematics; Laxmi Publications.

## BAS-02 ENGINEERING PHYSICS-I

**Course category** : Basic Sciences & Maths (BSM)

**Pre-requisite Subject** : NIL

**Contact hours/week** : Lecture : 3, Tutorial : 1 , Practical: 2

**Number of Credits** : 5

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Three Minor tests and One Major Theory & Practical Examination

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basics of relativity and its application in Engineering.
2. Quantum Mechanics and its application to understand material properties.
3. Statistical mechanics and its application in study of Macro and Micro scale properties of Matter.
4. Use of the principle of optics in the measurement.
5. Applications of Laser and holography in Engineering.
6. Basic Principles of optical Fibre and its application in Engineering.

### Topics Covered

#### UNIT-I

**Relativistic Mechanics:** Inertial and Non-inertial Frames of reference, Galilean transformation, Michelson-Morley Experiment, Postulates of special theory of relativity, Lorentz Transformation, Length contraction, Evidences of length contraction, Time dilation, Evidences for time dilation, Relativistic velocity transformation, Relativistic variation of mass with velocity, Evidence of mass variation with velocity, Relativistic kinetic energy, Mass energy equivalence, Examples from nuclear physics, Relativistic energy-momentum relation. 9

#### UNIT-II

**Statistical Mechanics:** Brief Introduction of Classical Statistics, Bose Einstein Statistics, Application to Black body radiation, distribution law of energy, Planck's radiation formula and Stefan's law. Fermi – Dirac statistics, Application to electrons in metals (energy distribution, Fermi energy). 9

**Quantum Mechanics:** De Broglie waves and Group velocity concept, Uncertainty principle and its application, Davisson-Germer experiment, Derivation of Schrodinger equation for time independent and time dependent cases. Postulates of quantum mechanics, Significance of wave function, Application of Schrodinger wave equation for a free particle (one dimensional and three dimensional case), Particle in a box (one dimensional and three dimensional), Simple harmonic oscillator (one dimensional and three dimensional).

#### UNIT-III

**Geometrical Optics:** General theory of image formation: Cardinal points of an optical system; general relationships, thick lens and lens combinations. 9

**Optical instruments:** Need for a multiple lens eyepiece, common type of eyepieces

#### Physical Optics:

**Interference:** Interference of light, Interference in thin films (parallel and wedge shaped film), Newton's rings.

**Diffraction:** Single, double and N- Slit Diffraction, Diffraction grating, Grating spectra, dispersive power, Rayleigh's criterion and resolving power of grating.

**Polarization:** Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Retardation Plate, Polarimeter

#### UNIT-IV

#### Modern Optics

**Laser:** Spontaneous and stimulated emission of radiation, population inversion, concept of 3 and 4 level Laser, construction and working of Ruby, He-Ne lasers and laser applications. 9

**Fiber Optics:** Fundamental ideas about optical fiber, Propagation mechanism, Acceptance angle and cone, Numerical aperture, Propagation Mechanism and communication in fiber Single and Multi Mode Fibers, step index and graded index fiber, attenuation and losses.

**Holography:** Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography.

## EXPERIMENTS

1. To determine the wavelength of monochromatic light by Newton's Ring
2. To determine the specific rotation of cane sugar solution using polarimeter
3. To determine the wavelength of spectral lines using plane transmission grating.
4. To verify Brewster's law using rotating Nicol prism
5. To verify Stefan's law by electrical method
6. To Study resonance in LCR circuit with a c source.
7. To determine the height of a tower with a Sextant.
8. To determine the refractive index of a liquid by Newton's ring.

## Books & References

1. Introduction to Special theory Relativity-Robert Resnick, Wiley Eastern Ltd.
2. Statistical Mechanics and Properties of Matter- E S R Gopal, John Wiley and Sons
3. Quantum Mechanics: Theory and Applications- Ajoy Ghatak, Tata McGraw-Hill
4. Optics- Ajoy Ghatak, Tata McGraw-Hill
5. Optics- N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S. Chand
6. Fiber optics and laser Principles and Applications-Anuradha De, New Age International
7. Concepts of Modern Physics-Arthur Beiser, Tata McGraw-Hill

## BAS-03 PROFESSIONAL COMMUNICATION

<b>Course category</b>	: Humanities & Social Science Core (HSSC)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 4
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of communication skills, such as, Reading, Writing, Listening and speaking skills.
2. To identify, formulate and solve the real life problems with positive attitude.
3. To inculcate the habit of learning and developing the communication and soft skills by practice.

## Topics Covered

### UNIT-I

9

#### Communication

Principles of Communication – Communication as coding and decoding – signs and symbols – verbal and non –verbal symbols – Language AND communication; language VS communication, language as a tool of communication – media/channels for communication : Types of Communication- functional, situational, verbal and non-verbal, interpersonal, group, interactive, public, mass line, dyadic – with illustrations LSRW in Communication – Listening – active vs passive (Talk less, listen more); Speaking - Speech vs. enunciation (mind your tone); Reading – Focus on the structure not on the theme alone, Technical Communication, General Communication, Barriers of Communication, Levels of Communication

### UNIT-II

9

### **Language Acquisition through Grammar, Usage and Mechanics of Writing**

Vocabulary, Phrase, Clause, Parts of Speech: Types ,Examples with Use Gender, Singular, Plural, Article, Sequence of Tenses, Use of Modifiers, Sentence-Loose Sentence, Periodical Sentence, Topic Sentence, Paragraph-Different Orders and Methods of Paragraph Writing, Inductive Method, Deductive Method, Spatial Method, Question and Answer Method, Chronological Method, Expository Method, Common Errors, Antonyms, Synonyms, One- word Substitutes, Homophone, Homonym, Comprehension and Précis, Words Frequently Misspelt, Punctuation and Capitalization, Abbreviations and Numerals ,Proofreading, Using the Library

#### **UNIT-III**

9

#### **Technical Writing**

Report Writing: Meaning, Types, Structure, Methods and Models of Report Writing, Technical Proposal; Concept, Kinds, Layout, and Examples of Technical Proposal, Definitions, Characteristics, Structure, Letter Writing: Importance, Types, Layout, and examples of letters, Scientific and Technical Writing: Features, Methods, Examples, Project, Thesis and Dissertation Writing

#### **UNIT-IV**

9

#### **Spoken and Presentation Skills**

Impromptu speech – tackling hesitation, shyness and nervousness in speaking – Public speaking, academic and professional presentations – Group discussions – facilitators and impediments Planning, preparing and delivering a presentation, essentials of presentation - etiquette; clarity; lively delivery – Speech generation; speech rhythm; speech initiators body language – voice, posture and gesture; eye contact; dress codes; verbal crutches; stresses, pronunciation – contextualization – creating and understanding contexts, Speech Drill.

#### **Books & References**

1. Complete Course in English - Dixon Robert J., Prentice Hall of India, New Delhi
2. A Practical English Grammar - Thomson and Martinet, ELBS
3. English Pronouncing Dictionary - Jones Daniel, Paperback
4. Spoken English - Bansal ,R.K. & Harrison J.B., Orient Longman, India
5. Handbook of Pronunciation of English Words - Sethi J. & Jindal D.V.A, Prentice Hall of India, New Delhi
6. Word Power Made Easy - Lewis, Norman, Pocket Books
7. Business Correspondence and Report Writing - Sharma R.C. & Mohan Krishna, Tata McGraw Hill
8. Business Communication - Chhabra T.N., Sun India Publication, New Delhi

### **BAS-04 ENVIRONMENTAL CHEMISTRY**

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 4
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge about environment, which allows students to gain

qualitative and quantitative skills.

2. Students will be aware of environmental pollution and control methods along with quality standards of air, water etc along with waste management.
3. Students will be able to give systematic account of natural resources their use of exploitation and environmental
4. Students will acquire basic knowledge about the chemical reactions taking place in the environment.

### Topics Covered

#### UNIT-I 9

Basic concept of Environmental chemistry, Introduction to atmospheric chemistry, Layers of the atmosphere and their chemical composition, chemistry of gaseous and particulate pollutants, Stratospheric ozone depletion, Ozone Holes, stratospheric ozone chemistry, Fossil fuel burning, CO<sub>2</sub> emissions, Greenhouse Effect Troposphere air pollution, concept of fog and smog, Consequences of air pollution. The Human Health Effects of Outdoor Air Pollutants

#### UNIT-II 9

The Chemistry of Natural Waters, Oxidation-Reduction Chemistry in Natural Waters, Ion Concentrations in Natural Waters and Drinking Water, Water Pollution and Purification of Water, Water Disinfection, Desalination of Salty Water, Groundwater: Its Supply, Chemical Contamination, and Remediation The Chemical Contamination and Treatment of Wastewater and Sewage. Management of water resources.

#### UNIT-III 9

Toxic Heavy Metals, Mercury, Lead, Arsenic and chromium, Soil pollution, Domestic and Commercial Garbage: Its Disposal and Minimization. The Recycling of Household and Commercial Waste, Hazardous Wastes and methods of disposal

#### UNIT-IV 9

Toxic Organic Compounds, Pesticides, Insecticides, Herbicides, Dioxins, Furans, and PCBs, Polynuclear Aromatic Hydrocarbons Chemistry of food additives, dyes, detergents and bleaching agents

### Books & References

1. Environmental Chemistry - Colin Baird and Michael Cann, W. H. Freeman
2. Environmental Chemistry - Stanley E. Manahan, CRC Press; 9<sup>th</sup> edition

## BAS-05 ENVIRONMENT & ECOLOGY

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 2, Tutorial : 1, Practical: 0
<b>Number of Credits</b>	: 3
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge in Environment and Ecology, which allows

students to gain qualitative and quantitative skills.

2. Students will aware of environmental pollution and control methods along with quality standards of air, water etc along with waste management.
3. Students will able to give systematic account of natural resources uses and their exploitation.
4. How to achieve sustainable development through strategies and its threats.

## **Topics Covered**

### **UNIT-I**

6

The Multidisciplinary nature of environmental studies, Definition, scope and importance, Need for public awareness. Natural Resources, Renewable and non-renewable resources, Natural resources and associated problems

- (a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining.
- (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources,
- (d) Food resources: World food problem, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
- (e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.

### **UNIT-II**

6

#### **Ecosystems**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest ecosystem (b) Grassland Ecosystem (c) Aquatic ecosystems (ponds, rivers, oceans)

#### **Biodiversity**

Introduction- Definition : genetic, species and ecosystem diversity, Biogeographically classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, Endangered and endemic species of India, Conservation of biodiversity:

### **UNIT-III**

6

Environmental Pollution Causes, effects and control measures of-

- (a) Air Pollution. (b) Water Pollution. (c) Soli Pollution (d) Marine Pollution. (e) Noise Pollution. (f) Thermal Pollution.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution

Global warming and green house effect, Acid Rain, Ozone Layer depletion

### **UNIT-IV**

6

Environmental Protection- Role of Government, Legal aspects, Initiatives by Non-governmental Organizations (NGO), Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Human Population and the Environment

Population growth, Population explosion- Family Welfare Programme, Environment and human health, Environmental Education, Women Education., Women and Child Welfare

## **Books & References**

1. Environmental Studies - J Krishnaswamy , R J Ranjit Daniels, Wiley India
2. Environmental Science - Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall
3. Environment and Ecology - R K Khandal, 978-81-265-4277-2, Wiley India
4. Environmental Science – 8<sup>th</sup> edition ISV, Botkin and Keller, 9788126534142, Wiley India
5. Environmental Studies - Soli. J Arceivala, Shyam, R Asolekar, McGrawHill India, 2012
6. Environmental Studies - D.L. Manjunath, 9788131709122 Pearson Education India, 2007

## **BAS-06 SPACE SCIENCE**

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 2, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 3
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Breadth and depth of knowledge in Space Science subject.
2. Students will find a useful place for applying their engineering knowledge and skills in the domain of Space Science and broadly saying astrophysics.
3. Group learning and problem solving.
4. The tools and techniques which can help them to peep into the Universe and fiddle the riddles there in.

### **Topics Covered**

#### **UNIT-I**

6

**Observational Astronomy:** Introduction ancient age astronomy and the scientific revolution of Copernicus and Galileo, Astronomical techniques: Telescope, its construction, functioning, resolving and its light gathering power, Use of balloon for observations on earth, Requirement of rocket and satellite technology, Charge Couple Device (CCD) as an optical detection system, An overview of Radio, infrared, microwave, ultra-violet, X-rays &  $\gamma$  –rays telescope with specific examples and their pioneering breakthroughs, An overview of near earth and space explorations using satellite, robotic and manned missions, Gravitational redshift by sun, clock rates in satellites, Gravitational lensing, Perihelion motion of mercury, Importance of observational astronomy and telecommunication.

#### **UNIT-II**

6

**Our Solar System:** Origin of our solar system, Sun and its theoretical model, Energy production inside stars: proton-proton chain & CNO cycle, Sun's chromosphere, Solar storm and the solar wind, Neutrinos from Sun, The description of eight planets and their moons with their atmospheric and geographical conditions & vital statistics, Removal of Pluto from the list of nine planets, Classification of planets, The green house effect, Existence in favor water in remote past of mars, Other planetary bodies: Asteroids, comets and meteorites, The cosmic dust, Oort cloud and the Kuiper's belt, The great comet crash: Shoemaker-Levy, Types of asteroids and their properties, The direct and indirect spectroscopy.

Titus-Bode law, Kepler's laws of planetary motion, Newton's law of gravitation from Kepler's law of planetary motion

### UNIT-III

6

- (a) **Stars and their classification:** Harvard classification of stars, Morgan-Keenan system, spectral classification of stars, The Hertzsprung-Russel diagram: main sequence stars, red and super-red giants, dwarf stars and black holes, Sun's evolution in H-R diagram, The Schwarzschild solution: massive stars, singularity and the black holes, Loss of information from a black hole, Accretion of mass and emission of jets in a binary star system: neutron star, black hole, Theory of compact stars: White dwarf stars and neutron stars; their evolution and equilibrium.
- (b) **Large celestial bodies:** Our galaxy, Types of galaxies: Elliptical, Spiral and SO type of galaxies, Irregular galaxies, their morphology, evolution and contents, Hubble's tuning fork diagram, Cluster of galaxies and their evolution, Collision and merger of galaxies, Active galaxies: Exploding galaxies, Seyfert galaxies, Quasars and pulsars etc.

### UNIT-IV

6

**The Big-Bang Theory:** The expanding universe: Hubble's law and constant, The flaw in Hubble's measurement, The hot big-bang model: arguments in its favor and against, The evolution of the universe after big-bang: description of different phases, matter, energy and forces, Models of the Universe: the closed, open and flat models and their relevance with observations, Origin of various bands of electromagnetic bands of spectrum in Universe, COBE: black body spectrum of the Universe, The existence of dark matter and dark energy: composition, Role of dark matter and dark energy in evolution of Universe, Cosmic rays, Creation of mass and the God particle.

### Books & References

1. Introduction to Cosmology- J. V. Narlikar, Cambridge University Press
2. Introduction to Special Relativity and Space Science - Satya Pal Singh, Wiley India Pvt. Ltd., New Delhi
3. Observational Astronomy - D. Scott Birney, Guillermo Gonzalez and David Oesper, Cambridge University Press.
4. Observational Astronomy: Technique and Instrumentation - Edmund C Sutton, Cambridge University Press
5. 100 Billion Suns: The Birth, Life and Death of Stars - Kippenhahn R, Weidenfeld and Nicolson

## BAS-07 ENGINEERING MATHEMATICS – II

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 4
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various mathematical techniques such as differential operators, matrix algebra and vector differentiation and integration.
2. To identify, formulate and solve the real life problems.
3. To inculcate the habit of mathematical thinking and lifelong learning.

## Topics Covered

### UNIT-I 9

**Differential Equations:** Linear differential equations with constant coefficients ( $n^{th}$  order), complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems

### UNIT-II 9

**Special functions:** Series solution of second order differential equations with variable coefficient (Frobenius method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials

### UNIT-III 9

**Laplace Transform:** Laplace Transform, Laplace transform of derivatives and integrals. Unit step function, Laplace transform of Periodic function. Inverse Laplace transform, Convolution theorem, Applications to solve simple linear and simultaneous differential equations.

### UNIT-IV 9

**Fourier Series and Partial Differential Equations:** Periodic Functions, Fourier Series of period  $2\pi$ , Change of interval, Even and Odd functions, Half range Sine and Cosine Series. Harmonic analysis, Partial Differential Equations with constant coefficients

### Books & References

1. Higher Engineering Mathematics - B.S. Grewal, Khanna Publishers
2. Engineering Mathematics - H.K. Dass and Rama Verma, S. Chand Publications
3. Engineering Mathematics - N.P. Bali and Manish Goel, Laxmi Publications
4. Higher Engineering Mathematics - B.V. Ramana, Tata McGraw Hill Education Pvt. Ltd., New Delhi

## BAS-08 ENGINEERING PHYSICS-II

**Course category** : Basic Sciences & Maths (BSM)

**Pre-requisite Subject** : NIL

**Contact hours/week** : Lecture : 3, Tutorial : 1 , Practical: 2

**Number of Credits** : 5

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Three Minor tests and One Major Theory & Practical Examination

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basics of crystallography application in Engineering
2. Use of the principles of sound wave and acoustics in civil engineering with the consideration of NDT.
3. Basic principles of electricity and magnetism applied in Engineering.
4. Maxwell's equation of electromagnetic theory and its application in engineering.
5. Basic principles of semiconducting materials and its application.
6. Basic Principles of Superconductivity and its application in Engineering.

## Topics Covered

### UNIT-I

9

**Crystal Structures and X-ray Diffraction:** Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Crystal structure of NaCl and diamond, Lattice planes and Miller Indices, Reciprocal Lattice, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer.

### UNIT-II

9

**Sound Waves and Acoustics:** Sound waves, intensity, loudness, reflection of sound, echo; Reverberation, reverberation time, Sabine's formula, remedies over reverberation; Absorption of sound, absorbent materials; Conditions for good acoustics of a building; Noise, its effects and remedies; Ultrasonics –Production of ultrasonics by Piezo-electric and magnetostriction; Detection of ultrasonics; Engineering applications of Ultrasonics (Non-destructive testing).

### UNIT-III

9

**Electrodynamics –I:** Basic concepts of Gauss's law, Ampere's law and faradays law of electromagnetic induction. Correction of Ampere's law by Maxwell (concept of displacement current), Maxwell's equation, transformation from integral form to differential form, physical significance of each equation

**Electrodynamics –II:** Maxwell's equation in free space, velocity of electromagnetic wave, transverse character of the wave and orthogonality of E, H and k vectors, Maxwell's equations in dielectric medium and velocity of e. m. wave, comparison with free space, Maxwell's equations in conducting media, solution of differential equation in this case and derivation of penetration depth

### UNIT-IV

9

#### Physics of Advanced Materials

**Semiconducting Materials:** Concept of energy bands in solids, Carrier concentration and conductivity in intrinsic semiconductors and their temperature dependence, carrier concentration and conductivity in extrinsic semiconductors and their temperature dependence. Hall effect in semiconductors, Compound semiconductors, Optoelectronic Materials.

**Superconducting Materials:** Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Temperature dependence of critical field, Type I and Type II superconductors, Electrodynamics of superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Superconductors.

**Nano-Materials:** Basic principle of nanoscience and technology, structure, properties and uses of Fullerene and Carbon nanotubes, Applications of nanotechnology.

## EXPERIMENTS

1. To determine the specific resistance of a given wire using Carrey Foster's Bridge.
2. To study the variation of magnetic field along the axis of current carrying circular coil.
3. To study the Hall's effect and to determine Hall coefficient in n type Germanium.
4. To study the energy band gap of n- type Germanium using four probe method
5. To determine  $e/m$  of electron using Magnetron valve
6. To draw hysteresis curve of a given sample of ferromagnetic material
7. To determine the velocity of Ultrasonic waves
8. To determine the Elastic constants ( $Y$ ,  $\eta$ ,  $\sigma$ ) by Searl's method

## Books & References

1. Introduction to Solid State Physics- Kittel , 7<sup>th</sup> edition, Wiley Eastern Ltd.
2. Solid State Physics - S. O. Pillai, 5<sup>th</sup> edition, New Age International.
3. Introduction to Electrodynamics- David J. Griffiths Pearson, New International Edition
4. Semiconductor Devices and Application - S.M. Sze, Wiley
5. Introduction to Nano Technology - Poole Owens, Wiley India
6. Master Hand book of Acoustics - F. Alton Everest and Ken Pohlmann, 5<sup>th</sup> edition, McGraw Hill

## **BAS-09 ENGINEERING CHEMISTRY**

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 2
<b>Number of Credits</b>	: 5
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Three Minor tests and One Major Theory & Practical Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge in Engineering Chemistry, which allows students to gain qualitative and quantitative skills.
2. Make good scientific observations and develop experimental method of evaluation of different systems at industrial or research level.
3. Students will develop Interdisciplinary skills which can help them to thrive in the life-long changing environment in various fields of Industry.
4. Students will acquire practical knowledge and will be able to analyze data constructively and formulate new ideas.

### **Topics Covered**

#### **UNIT-I**

9

Molecular orbital theory, LCAO approximation, MO diagrams of diatomic molecules. Band theory of metallic bond, Hydrogen bonding, Structure of graphite and fullerene- C<sub>60</sub>, Liquid crystallite state, classification and applications of liquid crystals, Types of unit cell, space lattice (only cubes), Bragg's Law, Calculation and density of the cubic unit cell, Phase Rule and its application to water system.

#### **UNIT-II**

9

Inductive, mesomeric and hyperconjugative effects, stability of reactive intermediates, e.g. Carbocation, Carbanion and free radicals. Types of organic reactions, mechanism of nucleophilic substitution and elimination reactions. Mechanism of organic name reactions (Cannizzaro reaction, Aldol condensation, Pinacol-pinacolone rearrangement, Beckmann rearrangement, Hoffmann rearrangement & Diels Alder Reaction)

Stereoisomerism of organic compounds containing one & two chiral centers. Enantiomers & diastereomers, R-S & E-Z Nomenclature. Examples of optically active compounds without chiral centre. Conformations of butane.

#### **UNIT-III**

9

Introduction & classification of polymers, Chain and Step growth polymerization, Thermoplastic and Thermosetting resins, Elastomers and synthetic fibers. Mechanism of chain polymerization, Stereoregular polymers, Synthesis and applications of: Polyethylene, Poly propylene, PVC, PMMA, PAN, PET, Polyamides, Polyurethane, Natural and synthetic Rubbers, Phenol Formaldehyde Resin. Conducting & biodegradable polymers and their applications.

Cement and its applications.

Classification of Fuels, calorific value of fuel, gross & net calorific value, determination of calorific value using Bomb calorimeter.

## UNIT-IV

9

Basic principles of spectroscopic methods, Basic principles of UV-Visible, IR,  $^1\text{H}$  NMR & Mass spectroscopy, determination of structure of simple organic compounds.

Hardness of water, Softening of water (Zeolite process, Lime Soda process & Ion exchange process). Treatment of boiler feed water by Calgon process.

### EXPERIMENTS

1. Determination of iron content in the given sample using  $\text{K}_3[\text{Fe}(\text{CN})_6]$  as an external indicator.
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
3. Determination of alkalinity in the given water sample.
4. Determination of chloride content in the given water sample by Mohr's method.
5. Determination of percentage of available chlorine in bleaching powder sample.
6. pH-metric titration between strong acid and strong base.
7. Viscosity of a polymer like polystyrene by Viscometric method.
8. Element detection & functional group identification in organic compounds
9. Preparation of a polymer like Bakelite or PMMA.
10. Preparation of Sodium Cobaltinitrile salt.

### Books & References

1. Engineering Chemistry, Wiley India
2. Engineering Chemistry, Tata McGraw Hill
3. Concise Inorganic Chemistry - J.D. Lee; Wiley India
4. Organic Chemistry- Morrison & Boyd, 6<sup>th</sup> edition, Pearson Education
5. Physical Chemistry - Gordon M. Barrow; McGraw Hill
6. Physical Chemistry - Peter Atkins & Julio De Paula, Oxford University Press

## BAS-10 TECHNICAL WRITING

<b>Course category</b>	: Humanities & Social Science Electives (HSSE)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 2, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 3
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Overcome the problems he/she faces in oral and written communication.
2. Acquire knowledge of and methods for using technical communication, such as, reports, proposals and business letters etc.
3. Use and practice compositions correctly.
4. Give Presentations in different sessions and make self appraisal.

### Topics Covered

#### UNIT-I

6

The Sentence, The paragraph: Structure, types and Linking, Technical Vocabulary, Impersonal Style, Scientific Attitude Plain Statement, Interesting Composition, Miscellaneous Exercises, Definition, Description, Description of a process, Diagrams, Explanations, Technical Communication-Simplicity, Clarity and Conciseness of a Presentation, Blending of Artistic and Technical Writing, Usages in Grammar, Comprehension—Reading Listening, Précis Writing

#### **UNIT-II**

6

Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis, Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper, Order of a thesis and Paper Elements, Concluding Remarks ,Identification of Author and His Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing-Title, Keywords, Synopsis, Preface and abstract, Specimen—Thesis and Research Paper, Chapters and Sections-Introductory Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections-Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis

#### **UNIT-III**

6

Letter Writing\_ Formal and Informal Letters, Parts of a Letter, Types of Letters, Business Letters, Examples of Letter-Writing, Job Applications, C.V and Resume Writing, Stylistic Faults in Letter Writing, Report Writing, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal

#### **UNIT-IV**

6

Technical seminar-purpose, modes and methods, Interviewing skills-body language, gesture, posture, tips and tactics of interview, resume making.

Case study- objectives, methods, examples of various case studies

Audience Analysis: Industrial vs. non-industrial users; Exploring primary, secondary, tertiary users in contexts of production and use; Creating personas; Multicultural issues; Analyzing real-world examples

Estimating, tracking, and managing tech writing projects. Determine the project scope, Estimates and schedules, Assemble the team, Provide resources and leadership, Evaluate the project, Appendixes and Annexure, References, Peripherals—Official Formalities, Rights and Permission, Certificate and Copyright, Dedication, Acknowledgement, Correspondences.

Project making: Making a final Project on topics, given by the instructor.

#### **Books & References**

1. Technical Writing – O.P. Pandey, SK Kataria & sons
2. Interview Skills : Tips & Techniques – Anita Acharya, Yking Books
3. Managing Writers - Richard Hamilton, Penguin
4. Technical Writing Management: A Practical Guide - Steven A. Schwarzman
5. Technical Writing - R.S. Sharma, Radha Publications, New Delhi
6. Technical Writing - B.N. Basu, PHI Learning Pvt. Ltd., New Delhi
7. Lesikar and petit, Report writing for Business

### **BAS-11 HUMAN VALUES & PROFESSIONAL ETHICS**

**Course category** : Humanities & Social Science Electives (HSSE)

**Pre-requisite Subject** : NIL

**Contact hours/week** : Lecture : 2, Tutorial : 1 , Practical: 0

**Number of Credits** : 3

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination

**Course Outcomes** : The students are expected to be able to demonstrate the

following knowledge, skills and attitudes after completing this course

1. To create conducive environment for professionals to grow as good and responsible human beings imbining values and ethics.
2. Understanding the significance of environment.
3. Developing humanitarian outlook.

#### **Topics Covered**

##### **UNIT-I** 6

Origin, Meaning, and Definition of Value, Types of Values, Individual Value, Family Value, Societal Value, Human Value, Value in Education System, Understanding Happiness and Prosperity, Self Exploration and Natural Acceptance.

##### **UNIT-II** 6

Harmony in family, Harmony in Society, Values Leading to Harmony, Creating a world family, Harmony in Nature, Environment and Sustainable Developmental, Legal aspects of Environment, Holistic Perspectives of Values, Existence and Co-existence.

##### **UNIT-III** 6

Origin, Meaning and Definition of Ethics, Ethics: The science of the Morality of The Art of Correct Living ,Ethics in Human Acts, Ethics and Religion, Ethical Norms and Laws ,Ethics in Literature, Ethics in Science and Technology.

##### **UNIT-IV** 6

Ethical Approaches:- Theistic Approach, Atheistic Approach, General and Special Ethics, Professional Ethics: Ethics at work place, Ethics as Skill, Values and Ethics, Ethics with Value Education, Managerial and Business & Corporate Ethics, Corporate Social Responsibilities.

#### **Books & References**

1. Bangaria ,G.P et.al A foundation course in Human Values and Professional Ethics, Excel books.
2. Govindrajan, M Professional Ethics and Human Values, Eastern Economy Edition
3. Naagrazan, R.S. Textbook on Professional Ethics and Human Values, New age International.
4. Misra, Anuranjan and Shukla, Dr. R.K. Human values and Professional Ethics, Amazon(Paper Back).
5. Fernando, A.C Business Ethics: An Indian Perspective, Pearson,India.

## **BAS-12 INDUSTRIAL PSYCHOLOGY**

**Course category** : Humanities & Social Science Electives (HSSE)

**Pre-requisite Subject** : NIL

**Contact hours/week** : Lecture : 2, Tutorial : 1 , Practical: 0

**Number of Credits** : 3

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of psychology, it problems and understanding.

2. To identify, formulate and solve the real life problems with positive attitude.
3. To inculcate the habit of learning and developing the industrial problems from psychological eyes.

### Topics Covered

#### UNIT-I 6

##### **Introduction to Industrial Psychology and its basic concepts**

Nature, Importance and scope of Industrial Psychology, Scientific management, Time and motion study and human relations school

#### UNIT-II 6

##### **Individual in workplace**

Motivation and job satisfaction, Stress management, Organisational culture, Leadership and group-dynamic.

#### UNIT-III 6

##### **Work environment, Recruitment and selection**

Engineering Psychology, Fatigue and boredom, Work environment, Accident and safety, Job-analysis, Recruitment and selection, Psychological tests.

#### UNIT-IV 6

##### **Performance management and training**

Performance appraisal, Importance and Methods of Performance appraisal, Training and development- Concepts and Benefits to the organization.

### Books & References

1. Miner, J. B. (1992). Industrial/Organizational Psychology. N Y: McGraw Hill
2. Blum & Naylor (1962). Industrial Psychology. Its Theoretical & Social Foundations CBS Publication
3. Aamodt, M. G. (2007). Industrial/Organization Psychology: A Applied Approach (5e) Wadsworth /Thompson: Belmont, C. A.
4. Aswathappa K. (2008). Human Resource Management (Fifth edition) New Delhi: Tata McGraw Hill
5. Archana Deshpande (2010). Industrial Psychology, Sun India Publications, New Delhi.

## BAS-13 INDUSTRIAL SOCIOLOGY

**Course category** : Humanities & Social Science Electives (HSSE)

**Pre-requisite Subject** : -

**Contact hours/week** : Lecture : 2, Tutorial : 1 , Practical: 0

**Number of Credits** : 3

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of sociology, its problems and understanding.
2. To identify, formulate and solve the real life problems with positive attitude.
3. To inculcate the habit of learning and developing the industrial problems from

sociological perspectives.

### **Topics Covered**

**UNIT-I** 6

#### **Introduction to Industrial Sociology**

Nature, Scope and importance of Industrial Sociology, Development of Industrial Sociology and other social sciences. Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim

**UNIT-II** 6

#### **Rise and development of industry**

Early industrialisation- Types of productive systems- Evolution of Productive system and Development of Industry, Primitive Stage, Agrarian economy Stage, Handicrafts Stage, Guild System, Feudal or Manorial System, Putting out System, Industrial Revolution, Industrialisation- Causes and Consequences.

**UNIT-III** 6

#### **Contemporary issues in Industrial Sociology Industrial Policy Resolutions**

Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing nature of work and organization, Industrial Grievances, Industrial conflicts, Industrial disputes in India, Strike and Lock-out, Promote industrial Peace. Industrial Policy Resolutions.

**UNIT-IV** 6

#### **Industrial relations machinery in India**

Tripartite and Bipartite Machinery, Code of discipline and standing orders and Trade unionism, The National Commission on Labour, Industrial Relations and Technology, Sociological Approach to Industrial relations

### **Books & References**

1. Durae, Pravin. (2013). Dorling, Kindersley (India) P. Ltd. Pearson education in South Asia.
2. Archana Despandey (2010). Industrial Sociology., Sun India Publications, New Delhi.
3. Ramaswamy, E.A. and Ramaswamy, U. (1981), Industry and Labour, OU Press
4. Dhanagare, D.N. , Themes and Perspectives in Indian Sociology, Rawat
5. Chandoke, Neera & Praveen Priyadarshi (2009), Contemporary India: Economy, Society and Politics, Pearson

## **BAS-14 GRAPH THEORY**

**Course category** : Basic Sciences & Maths (BSM)

**Pre-requisite Subject** : NIL

**Contact hours/week** : Lecture : 3, Tutorial : 1 , Practical: 2

**Number of Credits** : 5

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Three Minor tests and One Major Theory & Practical Examination

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Write precise and accurate mathematical definitions of objects in graph theory.
2. Use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory.
3. Use mathematical definitions to identify and construct examples.
4. Validate and critically assess a mathematical proof.

## Topics Covered

### UNIT-I 9

**Preliminaries:** Sets, relations, functions & multi-sets, Inductive definition and proof by induction, Cardinality of sets Basic concepts of Graph Theory: Digraphs, graphs and other similar objects, Representations of diagraphs and graphs, Operations on graphs, degree sequence and isomorphism Connectedness and distance: Walks, trails, circuits, cycles, and paths, Connected digraphs and graphs, Weighted graphs and digraphs and distance

### UNIT-II 9

**Trees and their applications:** Basic properties of trees and forests, Minimum-weight spanning trees, Enumeration of labeled trees, Rooted trees and uniquely decipherable coding, Tree traversals and parentheses-free notations Networks and flows: Legal flows and capacities of cuts, The Ford-Fulkerson Algorithms and Maxflow-Mincut theorem

### UNIT-III 9

**Edge and Vertex traversal problems:** Euler circuits and Euler trails, Fleury's algorithm and the Chinese Postman problem, Hamilton cycles and the Travelling Salesman problem Planar embeddings of graphs: Basic properties of planar graphs, Kuratowski's theorem and non-planar graphs, The DMP planarity algorithm, Polyhedral graphs and geometric dual

### UNIT-IV 9

**Colorings and Matchings in graphs:** Legal colorings and k-colorable graphs, Chromatic Polynomial and Four color theorem, Matchings in graphs and Stable marriage algorithm Directed graphs: Tournaments, directed paths and cycles, connectivity and strongly connected digraphs, branching, Infinite graphs and digraphs

## EXPERIMENTS

1. Write a recursive program that computes the value of  $\ln(N!)$ .
2. Write a C program to Implement Euler Circuit which starts and ends on the same vertex.
3. Write a C Program to Implement Hamiltonian Cycle Algorithm.
4. Write a C Program to assign a colour to each of the states so that no two adjacent states share the same colour. The program should output each state and its colour. Example: Alabama touches Florida, Mississippi, Tennessee, and Georgia. Arkansas touches Louisiana, Texas, etc.
5. Graph implementation of BFS and DFS using C. 56
6. Write a C Program to Implement Euler Circuit problem. In graph theory, this starts and ends on the same vertex.
7. Write a C Program for the 'marriage problem', for N boys and N girls and an  $N \times N$  binary matrix telling us which pairings are suitable, and want to pair each girl to a boy. Implement perfect matching in a bipartite graph.
8. Write a C program to implement ford-fulkerson algorithm
9. Write A C program for the implementation of the Branch and Bound Algorithm: The Asymmetric Travelling Salesman Problem
10. Write a C program for Dijkstra's Algorithm for Finding Shortest Paths in Non-Negative Weight Graphs.
11. Write a C program to check whether the given graph is tree.
12. Write a C program to extract spanning tree (without using Kruskal and prim's Algorithm).
13. Write a C program to perform following operations on a given 2 connected graph i. Union ii. Intersection iii. deletion of a vertex iv. deletion of any edge v. fusion of 2 vertex

14. Write a C program to input an image (Graph) and find out its adjacency and incidence matrix.
15. Write a C program to extract walk, path from any vertex to any vertex in a given graph.
16. Write a C program for the i. test for emptiness ii. return the number of vertices iii. return the number of edges iv. test if a given vertex exists v. test if a given edge exists vi. add a vertex (this operation does not add any edge) vii. add an edge (this operation may result in adding new vertices) viii. delete a vertex (this operation may result in deleting edges) ix. delete an edge (this operation may result in deleting vertices)

#### Textbooks & Reference books

1. Graphs and Hypergraphs -Berge, C., New York: Elsevier, 1973.
2. Theory of Graphs and Its Applications - Berge, C., New York: Wiley, 1962.
3. Modern Graph Theory- Bollobás, B., New York: Springer-Verlag, 1998

### BAS-15 APPLIED ENGINEERING CHEMISTRY

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 2
<b>Number of Credits</b>	: 5
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Three Minor tests and One Major Theory & Practical Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge in Engineering Chemistry, which allows students to gain qualitative and quantitative skills.
2. Make good scientific observations and develop experimental method of evaluation of different systems at industrial or research level.
3. Students will develop Interdisciplinary skills which can help them to thrive in the life-long changing environment in various fields of Industry.
4. Students will acquire practical knowledge and will be able to analyze data constructively and formulate new ideas.

#### Topics Covered

##### UNIT-I

9

**Thermodynamics I:** First Law of thermodynamics and internal energy, state and state functions, sign convention for heat and work, nature of work, path dependence of heat and work. Enthalpy, heat changes at constant volume and constant pressure, heat capacities (CV, CP) and their relationship for ideal gases.

Change in internal energy ( $\Delta U$ ) and enthalpy ( $\Delta H$ ) of chemical reactions, relation between  $\Delta U$  and  $\Delta H$ , variation of heat of reaction with temperature (Kirchhoff's equation).

**Thermodynamics II:** Second Law of Thermodynamics, Carnot cycle, entropy, entropy changes in reversible and irreversible processes and of universe.

**Electrochemistry:** Arrhenius theory of electrolytic dissociation, Hydrolysis of salts, hydrolysis constant, buffer solutions, indicators and theory of acid-base indicators.

## UNIT-II

9

**Electrochemical Cells:** Reactions in reversible cells, free energy and emf of reversible cell. Single electrode potential (Nernst equation), its measurement and sign convention. Standard electrode potential. Emf of reversible cell from electrode potentials. Types of reversible electrode, reference electrodes. Applications of emf measurements: pH, and equilibrium constant. Potentiometric titration.

**Corrosion:** Causes of metallic corrosion, types of corrosion, measurements of corrosion by weight loss method, prevention (electrochemical and inhibitor).

**Chemical Kinetics:** Order and molecularity of chemical reactions, pseudo order and first order. Kinetic law for second order reactions, determination of the rate constant and order of reaction from kinetic data. Effect of temperature on rate of reaction, Arrhenius equation.

## UNIT-III

9

**Basic concepts of organic reactions.** Types of organic reactions (Addition, substitution, elimination and rearrangement reactions)

Electrophilic Substitution, Mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts (alkylation and acylation) reactions. Effects of substituents on orientation and reactivity.

Addition reactions, Hydration, hydroxylation, and hydroboration of alkenes.

## UNIT-IV

9

**Coordination compounds:** Nomenclature, Werner's theory. Isomerism. Sidgwick's EAN concept and Valence Bond Theory. Stereochemistry of coordination compounds with coordination no. 4, 5 and 6.

**Theories of Metal-Ligand bonding:** Limitations of valence bond theory; Crystal-field theory and crystal-field splitting in octahedral, tetrahedral and square planar complexes. Factors affecting the crystal-field splitting.

## EXPERIMENTS

1. Determination of the coefficient of viscosity of the given unknown liquids using Viscometer and identify the given liquid.
2. Study of the distribution of iodine between water and  $\text{CHCl}_3$ / butanol.
3. Determination of the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
4. Determination of the strength of NaOH solution with the help of oxalic acid.
5. Preparation of inorganic complex of copper/ nickel.
6. Preparation of polyacrylic acid by free radical polymerization.
7. Determination of  $R_f$  value by paper chromatography.
8. Determination of Surface Tension of a given liquid by Stalagamometer.
9. Preparation of iodoform from acetone.
10. Applications of TLC in the organic chemistry.

## Textbooks & Reference books

1. Engineering Chemistry, Wiley India
2. Engineering chemistry by Sivasankar, Tata McGraw Hill, New Delhi.
3. Physical Chemistry, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
4. Physical Chemistry by Peter Atkins & Julio De Paula; Oxford University Press
5. Physical Chemistry by Gordon M. Barrow; McGraw Hill
6. Chemical Kinetics and Reaction Dynamics by S.K. Upadhyay, Springer
7. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).
8. Inorganic Chemistry, J.E. Huheey, E.A. Keiter and R.L. Keiter, Pearson Education India, 2006.
9. Concise Inorganic Chemistry by J.D. Lee; Wiley India
10. Guidebook to Mechanism in Organic Chemistry by Peter Sykes, Orient Longman

11. Organic Chemistry by Morrison & Boyd; Pearson Education
12. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, and E. Wothers, Oxford Univ. Press, Oxford (2001).

## **BAS-20 COMMUNICAION SKILLS**

<b>Course category</b>	: Humanities & Social Sciences (HSS)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 0, Tutorial : 0 , Practical: 4
<b>Number of Credits</b>	: 2
<b>Course Assessment methods</b>	: Continuous assessment through three Viva voce, Practical work/record, attendance and Major Practical Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Overcome the problems he/she faces in oral and written communication.
2. Acquire knowledge of and methods for using technical communication such as reports, proposals and business letters, etc.
3. Use and practice compositions correctly.
4. Give Presentations in different sessions and make self appraisal.

### **Topics Covered**

<b>UNIT-I</b>	12
Software to be used: Learn to Speak English and Present individually and in group Introduction to vowel and consonant sounds; introduction to syllable stress; noun stress; voiced and voiceless sounds; diphthongs; rate of speech.	
<b>UNIT-II</b>	12
Fluency Building – word match, reading aloud, recognition of attributes, parts of speech in Listening, reading and writing.	
<b>UNIT-III</b>	12
Group Discussion, Argumentative Skills, Interview skills, completing the steps involved in Career, Life Planning and Change Management.	
<b>UNIT-IV</b>	12
Presentation skills, Extempore (on-spot speech delivery), Improving body language and cross-cultural communication with pictures, making an oral presentation in English.	

### **Books & References**

1. A Manual for English Language Laboratory, Sudha Rani, Pearson.
2. English Language Communication Skill (lab),
3. Malcome Goodale, “Professional Presentations”, (VCD) New Delhi: Cambridge University Press, 2005
4. Robert M. Sherfield and et al “Developing Soft Skills”,4th Edition, New Delhi, Pearson Education, 2009
5. Study Materials from CIEFL, Hyderabad

## **BAS-21 ENGINEERING MATHEMATICS-III**

**Course category** : Basic Sciences & Maths (BSM)  
**Pre-requisite Subject** : NIL  
**Contact hours/week** : Lecture : 3, Tutorial : 1 , Practical: 0  
**Number of Credits** : 4  
**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination  
**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of Residue theorem and Integral formula to evaluate various integrals.
2. Use of moments and kurtosis to find the type of curve.
3. To interpolate a curve using Gauss, Newton's interpolation formula.
4. To find the derivative of a curve and area of a curve.

### Topics Covered

**UNIT-I** 9

**Functions of Complex Variable:** Analytic function, C-R equations, Cauchy-Integral Theorem, Cauchy-Integral formula, Taylor's Series and Laurent Series, Zero's and Singularities, Residue theorem, Evaluation of the real integrals of the type  $\int_0^{2\pi} f(\cos \theta, \sin \theta)d\theta$  and  $\int_{-\infty}^{+\infty} f(x)dx$ .

**UNIT-II** 9

**Statistical Techniques:** Moments, Generating function for moments, Skewness, Kurtosis, and Curve fitting: Method of Least Squares, Fitting of Straight lines and Parabola. Correlation and Regression. Binomial Distribution, Poisson's Distribution, and Normal Distributions.

**UNIT-III** 9

**Numerical Techniques:** Solution of polynomial equations by Bisection, Regula-Falsi and Newton-Raphson's methods. Interpolation: Newton's forward and backward interpolation formulae, Lagrange's and Newton's divided difference methods for unequal intervals.

**UNIT-IV** 9

**Solution of Linear and Differential equations and Numerical Integration:** Solution of linear equations by Crout's method and Guass-Siedel method. Solution of ordinary Differential equations by Euler's, Picard's and Fourth order Runge-Kutta methods. Numerical Integration by Trapezoidal, Simpson's one-third and Simpson's three-eight rules.

### Books & References

1. B.S. Grewal - Higher Engineering Mathematics; Khanna Publishers.
2. B.V. Ramana - Higher Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. H.K. Dass and Rama Verma - Engineering Mathematics; S. Chand Publications
4. N.P. Bali and Manish Goel - Engineering Mathematics; Laxmi Publications

## BAS-22 NANOTECHNOLOGY

**Course category** : Basic Sciences & Maths (BSM)  
**Pre-requisite Subject** : NIL  
**Contact hours/week** : Lecture : 2, Tutorial : 1 , Practical: 0  
**Number of Credits** : 3

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Will be able to demonstrate breadth and depth of knowledge in nanoscience and nanotechnology.
2. The effect of dimensionality and size on material properties.
3. The tools and techniques which can help them to experimentally observe nanomaterials.
4. They can explore the material world with their advance possible applications in making devices and sophisticated instruments.
5. They can find the vital role of this emerging area across various engineering disciplines.

### **Topics Covered**

**UNIT-I** 6

#### **Introduction**

Definition of Nanoscience and Nanotechnology, Applications of Nanotechnology.

#### **Introduction to Physics of Solid State**

**Structure:** Size dependence of properties; crystal structures, Face Centered Cubic (FCC) and Hexagonal Closed Packing (HCP) nanoparticles; Tetrahedrally bounded semiconductor structures; lattice vibrations.

#### **Energy Bands**

Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors.

**UNIT-II** 6

#### **Quantum Theory For Nanoscience**

Time dependent and time independent Schrodinger wave equations. Particle in a box, Potential step, Overview of Reflection and tunneling, Penetration of Barrier, Electron trapped in 2D plane sheet, Quantum confinement effect in nanomaterials.

#### **Quantum Wells, Wires and Dots**

Preparation of Quantum Nanostructure; Size and Dimensionality effect.

**UNIT-III** 6

#### **Growth Techniques of Nanomaterials**

Lithographic and Non-lithographic techniques, Sputtering and film deposition in glow discharge, DC sputtering technique. Thermal evaporation technique, E-beam evaporation, Chemical Vapour Deposition (CVD), Pulsed Laser Deposition, Molecular beam Epitaxy, Sol-Gel Technique (No chemistry required), Electro-deposition, Chemical bath deposition, Ion beam deposition system.

#### **Some Important Nanostructures**

Bucky Ball, Carbon nanotubes, synthesis, properties and their applications.

**UNIT-IV** 6

#### **Tools for Characterization of Nanomaterials**

**Structure:** Crystallography, particle size determination, surface structure.

**Microscopy:** Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy (TEM).

### **Books & References**

1. Introduction to Nanotechnology - C.P. Poole Jr and F.J. Owens, Wiley India, New Delhi
2. Nano Materials - A.K. Bandyopadhyay, New Age International

3. Microcluster Physics - S. Sugano & H. Koizuoni, Springer 1998
4. Handbook of Nanostructured Materials & Nanotechnology” vol.-5, Academic Press, 2000

## **BAS-23 ENGINEERING MATHEMATICS-IV**

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 4
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of Laplace Transform to solve the differential equation.
2. Use of Fourier transforms and Z transforms to solve the differential equation.
3. To solve the partial differential equations using Lagrange and charpits metghod.
4. Application of partial differential equation in real life problems

### **Topics Covered**

#### **UNIT-I** 9

**Integral Transform I:** Laplace Transform Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac-delta function. Laplace transform of periodic function, Impulse function.

Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

#### **UNIT-II** 9

**Integral Transform II:** Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equation, wave equation.

Z- transform and its application to solve difference equations

#### **UNIT-III** 9

##### **Partial Differential Equations**

Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.

#### **UNIT-IV**

**Applications of Partial Differential Equations:** Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Laplace equation in two dimensions, Heat conduction equations up to two dimensions

### **Books & References**

1. B.S. Grewal - Higher Engineering Mathematics; Khanna Publishers.
2. B.V. Ramana - Higher Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. H.K. Dass and Rama Verma - Engineering Mathematics; S. Chand Publications

## **BAS-24 APPLIED COMPUTATIONAL METHODS**

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 2
<b>Number of Credits</b>	: 5
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To find the root of a curve using Bisection, Regula falsi Newton's Method.
2. Use of moments and kurtosis to find the type of curve.
3. To interpolate a curve using Gauss, Newton's interpolation formula.
4. To find the derivative of a curve.
5. To find the area of a curve.

### **Topics Covered**

#### **UNIT-I** 9

**Numerical Methods:** Solution of algebraic and Transcendental equations, Bisection method, Method of False position (Regula-Falsi method) and Newton-Raphson method, Solution of linear simultaneous equations; Gauss-Siedel method, Crout's method.

#### **UNIT-II** 9

**Interpolation and Numerical Integration:** Interpolation: Finite Differences, Difference operators, Newton's forward and backward interpolation formulae, Lagrange's formula for unequal intervals, Newton's divided difference formula for unequal intervals. Numerical Integration: Trapezoidal Rule, Simpson's one-third and three-eighth rules.

#### **UNIT-III** 9

**Numerical Solution of Ordinary Differential Equations and Difference Equations:** Picard's method, Taylor's Series method, Euler's method, Modified Euler's method, Runge-Kutta method of order four. Difference equations and their solutions. Rules for finding the particular integral.

#### **UNIT-IV** 9

**Statistical Methods and Probability Distributions:** Frequency Distributions, mean, mode, median, standard deviation, Moments, Skewness, Kurtosis, Types and measurement of Skewness and Kurtosis. Correlation; Regression and regression lines. Binomial Distribution, Poisson's Distribution, Normal Distribution.

### **Experiments**

1. To implement Regula-Falsi method to find root of algebraic equation.
2. To implement Newton-Raphson method to find root of algebraic equation.
3. To implement Newton's Divided Difference formula to find value of a function at a point.
4. To implement Numerical Integration by using Simpson's one-third rule.
5. To implement numerical solution by using Runge-Kutta method of order four to find solution of differential equation.

6. To implement numerical solution of differential equation by Picard's method.
7. To implement numerical solution of differential equation by using Euler's method.
8. To estimate regression equation from sampled data and evaluate values of standard deviation, regression coefficient.

#### **Books & References**

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers.
2. B.V. Ramana: Higher Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. H.K. Dass and Rama Verma: Engineering Mathematics; S. Chand Publications.
4. N.P. Bali and Manish Goel: Engineering Mathematics; Laxmi Publications.

### **BAS-25 PROBABILITY THEORY AND STOCHASTIC PROCESS**

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 4
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Define and apply basic concepts and methods of probability theory.
2. Use common probability distributions and analyse their properties.
3. Define and use the properties of Stochastic processes, especially random walks, branching processes, the Poisson and Wiener process, applied to real problem.
4. Explain the concept of measurability and define and work with sigma algebras and construct probability measures on sample spaces.

#### **Topics Covered**

<b>UNIT-I</b>	9
<b>Probability and Distributions</b>	
Definition of probability, Mutually exclusive events, Addition and Multiplication Theorems of probability. Conditional Probability, Baye's Theorem. Binomial Probability Distribution, Poisson's Probability Distribution, Normal Probability Distribution.	
<b>UNIT-II</b>	9
<b>Stochastic Programming</b>	
Stochastic linear programming, Stochastic non- linear programming, Stochastic Geometric programming, Stochastic Dynamic programming.	
<b>UNIT-III</b>	9
<b>Non- linear Programming: Unconstrained Optimization Techniques</b>	
Direct Search methods: Random Search methods, Univariate method, Rosenbrock's method of Rotating Co-ordinates, Simplex method, Indirect Search methods: Steepest Descent method, Quasi-Newton Methods.	
<b>UNIT-IV</b>	9
<b>Stochastic Inventory models and Classical Optimization Techniques</b>	

Single Period Problem without Set up Cost, Uniform Demand and continuous non-linear programming, Instantaneous demand and Discrete Replenishment, Set up cost zero, Lead time zero, Instantaneous demand and continuous Replenishment. Classical Optimization Techniques: Single variable optimization, and multi-variable optimization without constraints.

**Books & References**

1. B.S. Grewal-Higher Engineering Mathematics; Khanna Publishers.
2. S.S. Rao - Engineering Optimization: New Age International
3. Manohar Mahajan - Operation Research: Dhanpat Rai & Co. (Pvt.) Ltd.
4. H.K. Dass and Rama Verma - Engineering Mathematics: S. Chand and Co. Ltd. New Delhi

**BAS-26 OPTIMIZATION TECHNIQUES**

**Course category** : Basic Sciences & Maths (BSM)  
**Pre-requisite Subject** : NIL  
**Contact hours/week** : Lecture : 3, Tutorial : 1 , Practical: 0  
**Number of Credits** : 4  
**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination  
**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To find the root of a curve using iterative methods.
2. To interpolate a curve using Gauss, Newton’s interpolation formula.
3. Use the theory of optimization methods and algorithms developed for various types of optimization problems.
4. To apply the mathematical results and numerical techniques of optimization theory to Engineering problems.

**Topics Covered**

<b>UNIT-I</b>	9
<b>Classical Optimization Techniques:</b> Single variable optimization, Multi-variable with no constraints. Non-linear programming: One Dimensional Minimization methods. Elimination methods: Fibonacci method, Golden Section method.	
<b>UNIT-II</b>	9
<b>Linear Programming: Constrained Optimization Techniques:</b> Simplex method, Solution of System of Linear Simultaneous equations, Revised Simplex method, Transportation problems, Karmarkar’s method, Duality Theorems, Dual Simplex method, Decomposition principle.	
<b>UNIT-III</b>	9
<b>Non-Linear Programming: Unconstrained Optimization Techniques:</b> Direct search methods: Random jumping method, Univariate method, Rosenbrock’s method. Indirect search methods: Steepest Descent method, Cauchy-Newton Methods, Newton’s method.	
<b>UNIT-IV</b>	9
<b>Geometric Programming:</b> Polynomial, Unconstrained minimization problem, Degree of difficulty. Solution of an unconstrained <b>Geometric</b> Programming problem. Constrained minimization complementary Geometric Programming, Application of Geometric Programming.	

### Books & References

1. Engineering Optimization- S.S. Rao, New Age International
2. Applied Optimal Design-E.J. Haug and J.S. Arora; Wiley New York
3. Optimization for Engineering Design-Kalyanmoy Deb; Prentice Hall of India

## BAS- 27 DISCRETE MATHEMATICS

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 4
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use logical notation to define different function such as set, function and relation.
2. Use of basic properties of group theory in computer science.
3. Use of graph theory models to solve problems of connectivity and constraint satisfaction, for example, scheduling.
4. Use of induction hypotheses to prove formulae.

### Topics Covered

<b>UNIT-I</b>	9
<b>Set Theory, Relation and Function:</b> Definition of sets, Countable and uncountable sets, Venn Diagrams, Proofs of some general identities on sets. Definition and types of relation, composition of relation, equivalence relation, partial order relation. Function: Definition, types of function, one to one, into and onto function, inverse function, composition of functions.	
<b>UNIT-II</b>	9
<b>Algebraic Structures:</b> Definition, properties and types of algebraic structures, Semi groups, Monoid, Groups, Abelian group, properties of groups, Subgroups, Cyclic groups, Cosets, Factor group, Permutations groups, Normal subgroups, examples and standard results. Rings and fields: Definition and Standard results.	
<b>UNIT-III</b>	9
<b>Graphs:</b> Simple graph, multigraph, graph terminology, representation of graphs, Bipartite, regular, planar and connected graphs, connected components in a graph, Euler graphs, Hamiltonian path and circuits, graph colouring, chromatic number, chromatic polynomials. Tree: types and definition, rooted tree, properties of trees.	
<b>UNIT-IV</b>	9
<b>Combinatorics:</b> Basic counting Technique, Pigeon-hole principle, Discrete Numeric function, Recurrence relations and their solution, Generating function, Solution of recurrence relations by method of generating function.	

### Books & References

1. Discrete Mathematical Structures with applications to computer science - J.P. Tremblay and R. Manohar,

- Graph Theory with application to engineering and computer science - Prentice Hall
- Combinatorics: Theory and applications - V. Krishnamurthy, East

## **BAS-28 SOLID STATE PHYSICS**

<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 1 , Practical: 2
<b>Number of Credits</b>	: 5
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Three Minor tests and One Major Theory & Practical Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

- The fundamental concepts of crystal structure and various kinds of bonds in solid.
- The knowledge of crystal imperfections and different theories related to molar heat capacity.
- The knowledge of energy bands in insulators and semiconductors. Concept of Fermi level.
- The knowledge of electrical and optical properties of semiconductors and brief knowledge of superconductivity.

### **Topics Covered**

#### **UNIT-I** 9

##### **Crystal Structure and Binding**

Classification of Solids, Space lattice and Bravais lattice, Primitive and unit cell, Co-ordination number , Atomic packing factor, Atomic radii, Miller indices, Inter planner spacing, Important crystal structures (NaCl, CsCl, ZnS, graphite and diamonds), Primary and Secondary bonds, Ionic, covalent, metallic and hydrogen bonds, Vander wall bonds, Forces between bonds, Dislocation energy, Cohesive energy.

##### **Determination of Crystal Structure**

Bragg's law, Laue pattern, X-ray diffractometer, Determination of lattice parameters using XRD, Absorption of X-rays, Absorption edge.

#### **UNIT-II** 9

##### **Defects in Solids**

Various kinds of crystal imperfections, Point defect, Schottky and Frenkel defect, Dislocations, Edge and screw dislocation, Grain boundary, Effect of defects on electrical properties of materials.

##### **Lattice Dynamics and Thermal Properties**

Concept of lattice vibrations and thermal heat capacity, classical, Einstein and Debye theories of molar heat capacity and their limitations, concept of phonons.

#### **UNIT-III** 9

##### **Band Theory of Solids**

Allowed and forbidden energy bands, Classification of materials on the basis of energy bands, Energy bands in insulators and semiconductors, Fermi energy, effect of impurity addition on the

position of Fermi level in semiconductors.

#### UNIT-IV

9

##### **Semiconducting Properties of Solids**

Semiconductors, Carrier generation and recombination, Carrier drift and carrier diffusion, effect of temperature and impurity addition on the conductivity of semiconductors, Mobility of charge carriers, effect of temperature on mobility, Hall effect in semiconductors, Junction properties.

##### **Superconductivity**

Basic properties and types of superconductors; Thermodynamics of superconducting transition, London equation, Coherence length, Basic idea of BCS Theory, Elementary discussion of high  $T_c$  superconductors.

##### **Optical Properties of Solids**

Optical reflectance, Kramers-Kronig relations; Conductivity and dielectric function of collision electron gas; Basic Theories and models of luminescence, phosphorescence, thermoluminescence, electroluminescence and photo-conductivity; colour centres.

#### **EXPERIMENTS**

**Minimum Six experiments are to be conducted from the following:**

1. Measurement of dielectric constant at high temperature.
2. Determination of reverse saturation current of p-n junction.
3. Study of Energy Band Gap of p-n Junction.
4. Study of Junction Capacitance of p-n junction.
5. To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance.
6. To measure the photo-current as a function of the irradiance at constant voltage.
7. Measurement of resistivity of semiconductor by four probe method.
8. Determination of Energy Band Gap of semiconductor.

#### **Books & References**

1. J.P. Srivastava: Elements of Solid State Physics, (PHI New Delhi)
2. Solid State Physics by S.O. Pillai (New Age Science Ltd., New Delhi)
3. Solid state Physics by A-J. Dekkar (McMillan and Co., London)
4. Introduction to Solid State Physics by C. Kittel (Wiley Eastern, New Delhi)

#### **BAS-29 NUMERICAL METHODS**

**Course category** : Basic Sciences & Maths (BSM)

**Pre-requisite Subject** : NIL

**Contact hours/week** : Lecture : 3, Tutorial : 1 , Practical: 2

**Number of Credits** : 5

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To find the root of a function using Bisection, Regula falsi, Newton's Method, Aitken's method.
2. To interpolate a curve using Gauss, Newton's interpolation formula.
3. To solve the first order boundary value problem.

## Topics Covered

### UNIT-I 9

**Roots of equation:** Bisection method, Regula Falsi Method, Secant Method, Fixed point Iteration Method, Newton Raphson Method, Modified Newton Raphson Method for Multiple roots, derivation of rate of convergence, Aitken Method.

### UNIT-II 9

**Solutions of system of Linear equations and Eigen Value problem:** Linear equations: Direct method for solving systems of linear equations (Gauss elimination, Gauss Jordan, LU Decomposition, Cholesky Decomposition), Iterative methods (Jacobi, Gauss Seidel, Relaxation method). Algebraic Eigen value problem: Power method, Jacobi's method, Given's method.

### UNIT-III 9

**Numerical Quadrature:** Relationship in various difference operators, Newton Gauss Forward and Backward Interpolation, Lagrange and Newton divided difference interpolation, Newton Cotes Formula, trapezoidal Rule, Simpson's 1/3 and 3/8 rule, Gauss Quadrature Formula, Chebyshev's Formula, Piecewise Linear Interpolation, Cubic Spline Interpolation.

### UNIT-IV 9

**Numerical solution of Ordinary differential equations and, Difference Equation:** Single Step Methods: Taylor, Picard, Euler, Runge-Kutta Fourth Order Methods. Multistep methods: Milne's and Adam's predictor and corrector methods. Difference equations and their solutions, Rules for finding the particular integral.

## EXPERIMENTS

1. To implement Regula-Falsi method to find root of algebraic equation.
2. To implement Newton-Raphson method to find root of algebraic equation.
3. To implement Newton's Divided Difference formula to find value of a function at a point.
4. To implement Numerical Integration by using Simpson's one-third rule.
5. To implement numerical solution of differential equation by Picard's method.
6. To implement numerical solution of differential equation by using Euler's method.
7. To implement numerical solution of differential equation by using Runge – Kutta Method.

## Books & References

1. Numerical Methods: M.K. Jain, S.R.K. Iyenger and R.K. Jain, New Age Publishers.
2. Numerical Methods: P. Kandasamy, K.Thilagavathi, K.Gunavathi., S. Chand & Company.
3. Dr. B.S. Grewal; Higher Engineering Mathematics, Khanna Publishers, Delhi.
4. B.V. Ramana; Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi.

## MAS-109 FOREIGN LANGUAGE-FRENCH

<b>Course category</b>	: Audit Course
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 2, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 3
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of French language, its problems and understanding.
2. To identify, formulate and solve the real life problems with positive attitude.
3. To inculcate the habit of learning and developing the French knowledge

### Topics Covered

**UNIT-I** 6

Alphabets and numbers

Simple Grammar: Basics of French conversation (To greet a person, Introducing oneself, Asking basic information)

**UNIT-II** 6

Simple Grammar: Name and locate objects, colours and simple description of people.

Simple Grammar: Asking for directions, Giving suggestions.

**UNIT-III** 6

Simple Grammar: Indicate date and time. Asking and giving information on one's profession and activities.

**UNIT-IV** 6

Simple Grammar: Use of past tense. Narrating past events. Giving one's opinion.

### Books & References

1. "Taxi" – Guy Cappellet and Robert Menand.
2. NSF I (Nouveau sans frontières) - Philippe Dominique & Jacky Girardet.
3. Nouvel Espace I - Guy Cappellet
4. Cadences I – D. Berger & L. Mérieux

## MAS-110 FOREIGN LANGUAGE-GERMAN

**Course category** : Audit Course

**Pre-requisite Subject** : NIL

**Contact hours/week** : Lecture : 2, Tutorial : 1 , Practical: 0

**Number of Credits** : 3

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of German Language, its problems and understanding
2. to identify, formulate and solve the real life problems with positive attitude
3. to inculcate the habit of learning and developing the German knowledge

### Topics Covered

**UNIT-I** 6

- Alphabets and numbers (1 - 20)

- Simple Grammar: Articles (Definite, Indefinite, Negative), Nouns, Gender; Singular and plural. Conjugation of the auxiliary verb "To be" "Sein"

- Contextual Vocabulary and Dialogue: Greeting, Self Introduction, Simple questions.

- Hard Facts of Germany: (i) Fall of Berlin Wall (ii) Unification of Germany

**UNIT-II** 6

- Numbers (20 – 100)
- Simple Grammar: Conjugation of verbs, pronouns (personal and interrogative), Present tense, Imperative tense, auxiliary verb “To have”, “Haben”, Nominative and accusative cases.
- Contextual Vocabulary and Dialogue: At the Railway Station, Airport.
- Hard Facts of Germany: Education System.

**UNIT-III** 6

- Simple Grammar: Modal verbs, Past and perfect tenses, Dative case.
- Contextual Vocabulary and Dialogue: Idiomatic expressions, One’s family and background, Reading the time, days, months and year
- Hard Facts of Germany: Germany and the European Union.

**UNIT-IV** 6

- Simple Grammar: Irregular verbs, Separable and inseparable verbs, Reflexive pronouns, Possessive pronouns Revision of Grammar learn so far
- Contextual Vocabulary and Dialogue: Daily life, Meals, How to place an order in a restaurant.
- Hard Facts of Germany: Presentation of topics on German Civilization discussed earlier.

**Books & References**

1. “Komm Mit” – Level I – Holt, Rinehart & Winston
2. “Moment Mal!” - Level I
3. “Themen” - Level I
4. “Facts about Germany”
5. “Deutsch FÜR Ausländer” – Schulz-Griesbach

**MAS-111 FOREIGN LANGUAGE-SPANISH**

<b>Course category</b>	: Audit Course
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture : 2, Tutorial : 1 , Practical: 0
<b>Number of Credits</b>	: 3
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Three Minor tests and One Major Theory Examination
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of Spanish Language, its problems and understanding.
2. to identify, formulate and solve the real life problems with positive attitude
3. to inculcate the habit of learning and developing the Spanish knowledge

**Topics Covered**

**UNIT-I** 6

- Alphabet
- Introducing oneself
- Pronunciation
- Nouns, gender of the nouns
- Singular and plural of the nouns Articles: definite and indefinite
- Subject pronouns
- Number (1~100)

- Name of months and days

#### **UNIT-II**

6

- Present indicative of the two auxiliaries: Ser/Estar – Tener
- Hay / Están / Dónde está /están
- Adjectives
- The interrogative adjectives and pronouns ( cuanto? cual?)
- Nationalities
- Idiomatic expressions with “Tener” (Tener hambre/ sed/...)
- Culture and civilization

#### **UNIT-III**

6

- Present indicative of the three conjugations (AR-ER-IR)
- Negation
- Interrogative sentences
- Present indicative of a few common irregular verbs
- Present indicative of “ir” and “venir”
- Possession (de/ de quién)
- Culture and civilization

#### **UNIT-IV**

6

- Prepositions and their combination with the articles
- Possessive adjectives and pronouns
- Use of prepositions with “ir” and “venir”
- Present indicative of the verbs. Querer- Poder- Deber/Tener que
- Asking and expressing time
- Family vocabulary (family relations)
- Culture and Civilization

#### **Books & References**

1. Virgilio Borobio, Nuevo ELE 1, Curso de Español para extranjeros,2002, SM, Madrid.
2. Luis Aragonés y Ramón Palencia: Gramática de uso del Español, teoría y práctica, Ed. SM, Madrid.
3. Lisa Prange y Francisca Pichardo Castro: Por Turnos, Actividades para aprender español jugando, Ed. Difusión, Madrid.
4. Chamorro, M. D.: Abanico, libro del alumno, Ed. Difusión, Madrid.
5. Deutsch FÜR Ausländer – Schulz-Griesbach