

Course Content of 1st and 2nd semesters of B Tech.

SEMESTER 1

ESH101T ENGLISH FOR LEARNING AND COMMUNICATION

Lecture Hours: 2 per week

Topics:

1. Basic language skills and grammar
2. Phonetics and accent
3. Précis and Abstract Writing
4. Technical Report Writing
5. Creative Writing – Stories, Poems, First Person Narration, Diary, Skit
6. Academic Vocabulary
7. English for Business
8. Comprehending notices, advertisements, official documents, booklets, newspapers, instructional manuals and other documents
9. Group Discussion
10. Resume Writing
11. Interview Skills
12. Listening Practice
13. Appreciation of Movies

ESH101P ENGLISH FOR LEARNING & COMMUNICATION LAB

DETAILS OF LABORATORY SESSIONS

Practical Hours: 2 per week

- (1) First Session – Informal Acquaintance of Students, Students would one by one introduce themselves and tell their batch about their interests, skills, hobbies etc. This would not only remove their fear of speaking English but would also help one another to form friendship.
- (2) Second Session – First Creative Writing Task. (non graded) Here interesting and funny topics would be provided to students and they would have to write one page on the subject in the lab. itself. Students would volunteer to speak their writings. This would help the instructor to know the language skills of students especially in written English.
- (3) Third Session – Learning English from Songs. Students would be made to listen to some selected English songs and would be given exercises of grammar and vocabulary based on those songs.

- (4) Fourth Session - Quiz with Lab. software or with online sources. It would be in multiple choice format and would test students' awareness of vocabulary and grammar.
- (5) Fifth Session – Second Creative Writing Task. (graded)
- (6) Sixth Session – BBC Teacher Idioms Movies. In this session, award winning video serial of 'Teacher BBC' would be shown to students with the dual purpose of acquainting them with special use of idioms and making them listen to RP sounds. (Received Pronunciations)
- (7) Seventh Session – Third Creative Writing Task. (graded)
- (8) Eighth Session – Group Discussion
- (9) Ninth Session – Listening to BBC and Voice of America Special English Lessons. Here students would be introduced to etymology of many words as well as current colloquial expressions and their meaning. Audio clips with text are from both BBC and VOA – reputed resources for English.
- (10) Tenth Session – Skit or Extempore. At the start of the session, students would be given a topic. They would be given half an hour to prepare their script, decide characters and prepare. They would enact their skit at the end of the session.
- (11) Eleventh Session – Fourth Creative Writing Task (graded)
- (12) Twelfth Session – Movie Session. Documentary on academic subject would be shown. Duration – Half and hour to maximum one hour. At the end of the movie, students would discuss the movie.
- (13) Thirteenth Session – Rewriting an Internet article. (graded) Here, students would be asked to browse Internet for half an hour and find out an article of their choice on any topic. They would paste the entire article on MS Word Document as it is and then would rewrite the article in their own language.
- (14) Fourteenth Session - Group Discussion.
- (15) Fifteenth Session – American Stories. Audio Stories from Voice of America would be given to students and their comprehension would be assessed.
- (16) Sixteenth Session – Business English. Here students would be taught frequently used expressions in business. The resource is a combination of self-developed material + BBC + Voice of America.

Texts and References:

1. Business Communication Today - Courtland L. Bovee, Pearson Pub. India
2. E- Writing: 21st –Century Tools for Effective Communication, Dianna Booher,
3. Macmillan India Ltd., 2007, ISBN – 1403-93202-6
4. Cambridge Objective IELTS, Michael Black & Wendy Sharp, Cambridge Books
5. for Cambridge Exams, 2006, ISBN – 0-521-70052-3
6. Excellence in Business Communication, Courtland Bovee and John Thill,
7. Prentice Hall, ISBN – 9780131870475

8. English for Business Communication, Simon Sweeney, Cambridge University
9. Press (available in e book at SLS)
10. Professional English, Steve Flinders, Pearson Edu. Ltd., (available in e book at SLS).

ESH102T MATHEMATICS – I

Lecture Hours: 3 per week

Tutorial Hour: 1 per week

Calculus-I :

Indeterminate forms and L'Hospital's rule, Successive differentiation of one variable and Leibnitz theorem for the n^{th} derivative of product functions, Taylor's and Maclaurin's expansion of functions of single variable.

Partial Differentiation: Functions of several variables, partial derivatives, Euler's theorem on homogeneous functions, derivatives of composite and implicit functions, total derivatives, Jacobian's, Taylor's and Maclaurin's expansion of functions of several variables, Errors and approximations, Maxima and Minima of functions of several variables, Lagrange's method of undetermined multipliers.

Curvature and asymptotes, concavity, convexity and point of inflection, Curve tracing.

Infinite Series: Convergence and divergence of Infinite series. Comparison test, D'Alembert's ratio test, Raabe's test, logarithmic test, Cauchy's root test. Alternating series; Leibnitz test, Idea of absolute and conditional convergence, power series and uniform convergence.

Complex Numbers : Review of Complex numbers, De Moivre's theorem, Powers and roots of Exponential and Trigonometric functions. Circular and Hyperbolic functions. Relation between circular and hyperbolic functions. Inverse Circular and Hyperbolic functions. Logarithm of Complex numbers. Separation of real and imaginary parts of all types of functions.

Calculus –II :

Reduction formulae, Improper integrals, convergence of improper integrals, test of convergence, Beta and Gamma functions and its properties, differentiation under integral sign; differentiation of integrals with constant and variable limits; Leibnitz rule.

Multiple integrals: Evaluation of double integrals, change of order of integration, change of coordinates, evaluation of area using double integrals, Evaluation of triple integrals, change of coordinates, evaluation of volumes of solids and curved surfaces using double and triple integrals. Mass, center of gravity, moment of inertia and product of inertia of two and three-dimensional bodies and principal axes.

Texts and References:

1. **Elementary** Engineering Mathematics by B. S. Grewal, Khanna Pub., Delhi
2. Higher Engineering Mathematics by B. S. Grewal, Khanna Pub., Delhi

3. Calculus Vol. I & II – by T. M. Apostol, publication of Wiley Eastern
4. Calculus and Analytic Geometry – by G.B. Thomas & R.L. Finney, publication of Addison – Wesley / Narosa.
5. Differential Calculus by B.C. Das and B.N. Mukherjee
6. Integral Calculus by B.C. Das and B.N. Mukherjee
7. Integral Calculus by R.K. Ghosh and K.C. Maity
8. Analytical Solid Geometry by Shanti Narayan
9. Text Book of Engineering Mathematics by Debashish Dutta.

ESH103T PHYSICS-I

Lecture Hours: 3 per week

Tutorial Hour: 1 per week

Physical interpretation of Vector concepts:

Introduction to vector algebra, Physical concepts in vector fields and Scalar fields with examples, Physical and mathematical concepts of gradient, divergence and curl, Green's theorem, Gauss theorem, applications in gravitation and electrostatics. Stokes' theorem and its applications. Coordinate systems (polar, spherical and cylindrical – introduction).

Waves and oscillations:

Simple harmonic motion, Damped simple harmonic motion, types of damping, Forced oscillation, resonance, group velocity and dispersion, Types of waves, Energy Transport in Wave motion, Wave motion in one dimension, the one dimensional Wave equation.

Optics:

Interference: Introduction, Sinusoidal waves, Superposition of waves, Interference by division of wave front, Interference by division of amplitude: Anti-reflecting films; Colour of thin films; wedge shape films; Newton's rings and its applications, Michelson interferometer and its applications.

Diffraction: diffraction of light waves, Fraunhofer diffraction at a single slit, Two slit Fraunhofer Diffraction Pattern, N- Slit Fraunhofer Diffraction Pattern, diffraction grating, resolving power, Rayleigh Criterion, Fresnel diffraction (Introduction).

Polarization: Polarization of light, production of polarized light, types of polarization and their representation, Malus's law, , , polarizer and analyser, Double refraction, Interference of Polarized light: Quarter wave plates and Half wave plates, optical activity.

Acoustics & Ultrasonic:

Acoustics: Introduction, Sound, Reflection of sound, Defects due to reflected sound, absorption of sound, Sabine's formula, reverberation theory, Eyring's Equation, Doppler Effect.

Ultrasonic: Introduction, Generation of ultrasonic: Magnetostriction and piezoelectric methods, determination of velocity of ultrasonic waves (acoustic grating), applications.

Electromagnetic:

Electrostatics; Electrostatic field in matter: Electric field and potential due to a dipole, Dielectrics; displacement; electrostatic energy in dielectrics; boundary conditions for E and D. Magnetostatics: Magnetic field due to a moving charge, motion of charged particles in electric and magnetic fields; Boundary conditions on B and H. Hall effect; Electromagnetic Induction: Faraday's law, Lenz's law, energy in magnetic field Maxwell's equations and electromagnetic waves: Displacement currents, generalization of Ampere's law, Maxwell's equations, Energy flow in EM waves. Poynting's vector

The particle nature of radiation:

Dual nature of light, De Broglie's hypothesis, Uncertainty Principle, the particle nature of light, The photoelectric effect, The Compton effect.

Laser:

Interaction of radiation of matter-quantum mechanical view, The Einstein coefficients, Spontaneous and stimulated emission, Optical amplification and population inversion, meta stable state, optical resonator, the principle of pumping scheme, laser beam characteristics, Ruby Laser, He-Ne, lasers, applications. Introduction to Fiber optics.

Texts and References:

1. Resnick, Halliday and Krane, Physics part I and II, 5th Edition John Wiley (2002)
2. A. Ghatak, Optics, 3rd edition, Tata McGraw Hill (2005).
3. Kittel C., Knight W.O. and Ruderman M.A., Mechanics - Berkeley Physics Course, Vol. 1, Tata McGraw-Hill
4. Purcell E.M. Electricity and Magnetism - Berkeley Physics Course, Vol.2,
a. TataMcGraw-Hill
5. Crawford F.S. - Waves and Oscillations, Berkeley Physics Course, Vol. 3, McGraw- Hill
6. Feynman R.P., Leighton R.B. and Sands M. (Narosa) The Feynman Lectures on
a. Physics, Vol. 1
7. Feynman R.P., Leighton R.B. and Sands M. (Narosa) The Feynman Lectures on
a. Physics, Vol. 2
8. Griffith D.J.H., Introduction to Electrodynamics - (Prentice Hall, India).

ESH103P PHYSICS-1 LABORATORY EXPERIMENTS

Practical Hours: 2 per week

Sr.No.	Name of Experiment
1	Newton's ring
2	Michel Interferometer
3	Introduction to He-Ne Laser and its Diffraction
4	Forced oscillator resonance
5	Force between two charged plates.
6	Introduction to Cathode Ray Oscilloscope.
7	Biot-Savart's law
8	Hall effect experiment To determine the numerical aperture of the PMMA fiber
9	cable
10	Plank Constant by photocell
11	Viscosity
12	Ultrasonic diffraction
13	Analyzing polarization status of light beams Other experiments of Electromagnetism and Optics. Experiments in Electricity, Magnetism, Optics and Atomic Physics.

ESH104T CHEMISTRY

Lecture Hours: 3 per week

Polymer Chemistry: Classification of Polymers, Types of polymerization reactions, preparation of some commercially important polymers (Fibers, elastomers, adhesives and plastics, Nylon, Polyester, Rubber, Vulcanization of rubber, Synthetic rubber, Copolymers of butadiene and acrylonitrile, Resins: Phenol-formaldehyde Resins, Urea-formaldehyde, Epoxy resins, Melamine-formaldehyde resins, Biopolymers), polymers used in petroleum industry

Surface Chemistry: Interfacial Phenomena, Wetting, Surface Tension measurements, Electrokinetic's Phenomena, Zeta Potential and its Measurement. Adsorption: Types of Adsorption, Isotherms, Gibb's Adsorption Equation, BET Equation, Surface Area of Adsorbents, Application of Adsorption on The Surface of Solids, Adsorption of High Molecular Compounds, Catalytic Activity at Surface.

Electrochemistry: Debye-Huckel Theory of Electrolysis, Ostwald's Dilution Law, Acids and bases, concept of pH and pOH, Standard pH of various liquids and solutions, Buffer solutions, solubility product, common ion effect, hydrolysis of salts, conductometric titration, transport number, Redox reaction, presentation of potential data (Latimer Frost diagram).

Phase rule and phase equilibrium diagram: Phase rule ,Phase diagram for single component system(Carbon dioxide system, sulfur system, Carbon and Helium system), Two component system(KI-H₂O,Pb –Ag system), Freezing Mixture, Azeotropic Mixture, Solubility of partially miscible liquids, Liquid –Liquid and Liquid –Solid phase diagrams.

Lubricant: General characteristics of lubricants, mechanism of lubrication, Classification of lubricants, chemistry of lube oil and greases, Cutting fluids, Selection of lubricants, reclamation of lubricants,

Coordination Bond and its implications: Bonding in tetrahedral and octahedral complexes, Applications in analytical Chemistry, Biological System, Sandwich Compounds, Oxygen storage and transport.

Green Chemistry: Principles of Green Chemistry, Acid rain, Green house effect, Depletion of Ozone layer.

Texts and References:

1. Elements of Physical Chemistry, Peter Atkins, Julio de Paula, 5th Edition, Oxford University Press, New Delhi, 2010
2. Engineering Chemistry, Jain and Jain, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2010
3. Physical Chemistry, David W. Ball, Thomas Brooks
4. Environmental Chemistry, Stanley Manahan, 9th Edition, CRC Press, New York
5. Inorganic Chemistry, Shriver & Atkins, 4th Edition, Oxford University Press, New York

ESH104P CHEMISTRY LABORATORY

Practical Hours: 2 per week

Experiment-1: To synthesize the phenol formaldehyde resins.

Experiment-2: To synthesize urea formaldehyde resin.

Experiment-3: To determine the viscosity and viscosity index of lubricating oil.

Experiment-4: To determine surface tension of a given liquid at room temperature by using stalagmometer.

Experiment-5: To determine the specific rotation of glucose using polarimeter.

Experiment-6: To determine the amount and normality of given acid by using pH meter.

Experiment-7: To determine the strength of a given HCl against NaOH by using Conductivity meter.

Experiment-8: To determine the concentration of unknown solution by using spectrophotometer.

Experiment-9: To determine acid value of given oil sample.

Experiment-10: To determine saponification value of given oil sample.

Experiment-11: To determine iodine value of given lubricating oil sample.

- Experiment-12: To determine the transition temperature of $\text{Na}_2\text{SO}_4 \cdot 10 \text{H}_2\text{O}$ by thermometric method.
- Experiment-13: To determine the composition of solution at Critical Solution Temperature of phenol water system.
- Experiment-14: To estimate the percentage of available chlorine in given bleaching powder sample.
- Experiment-15: To determine the strength of a given ferrous ammonium sulfate solution by using N-phenyl anthranilic acid solution as an internal indicator

ESH105T COMPUTER PROGRAMMING

Lecture Hours: 2 per week

Introduction to computer software and programming; Understanding various number systems used in the computer; Writing Algorithm and Drawing Flowchart; Writing simple C++ programs to complex C++ programs; Understanding Object Oriented Programming (OOP); Implementation of OOP concepts through C++.

ESH105P COMPUTER PROGRAMMING LAB

Practical Hours: 2 per week

Difference between Hardware and Software, How computer executes a Program, Introduction to Algorithm and Flowchart, Algorithm and Flowchart (If Condition), Algorithm and Flowchart (Loop), Understanding Compiler, Writing simple C++ Programs, Writing C++ Programs (Using Functions , if condition), Writing C++ Programs (Loop), Writing C++ Programs (Arrays), Writing C++ Programs (Recursive Functions), Writing C++ Programs (Pointer), Writing C++ Programs (String), Writing C++ Programs (Structure), Writing C++ Programs (Classes and Objects), Writing C++ Programs (Polymorphism, Constructor), Writing C++ Programs (Friendly Function, Inheritance), Writing C++ Programs (File Handling)

Texts and References:

1. Let Us C, Yashavant Kanetkar, BPB Publications, 9th Edition
2. Object Oriented Programming with C++, E Balagurusamy, Tata McGraw-Hill, 3rd Edition.
3. The Complete Reference C++, Herbert Schildt, Tata McGraw-Hill, 4th Edition
4. C++ How to Program, Deitel & Deitel, Prentice-Hall India, 5th Edition

PET 101T INTRODUCTION TO PETROLEUM ENGINEERING

Lecture Hours: 2 per week

Introduction to Petroleum: origin of petroleum, composition & properties.

Petroleum Exploration: exploration methods & techniques; petroleum geology, sedimentary basins of India.

Drilling: system & equipment, various types of drilling rigs, various techniques of drilling.

Well logging and Formation Evaluation.

Concept of oil & gas production, gathering system, separation / treatment, storage and transportation.

Reservoir operation & management, well migration.

Concept of refining petroleum products

Type of gases and their uses

Major Oil producing countries and world wide scenario with respect to demand and supply of petroleum

Role of Petroleum Engineer as a professional and scientist

Texts and References:

1. Petroleum Engineering Drilling & Well completion by Carl Gatlin.
2. First Course in Petroleum Technology by David A.T. Donobue, Karl R. Lang.
3. Introduction to Petroleum production Vol.I, II, III by Dr. Skinner.
4. Natural Gas Engineering (Hand Book) by Donlad L. Katz.
5. An introduction to petroleum industry by Alponsus Fagon (Nov. 1991)

ESH106P FABRICATION TECHNOLOGY

Practical Hours: 2 per week

1. Introduction to fabrication technology, Importance and role of fabrication technology in oil and gas industry, classification of fabrication processes, overview of engineering materials.
2. Measuring instruments includes- Caliper, Micrometer, Dial gauge, Height gauge, etc.
3. Basics of wood working operations and tools.
4. Metal cutting and grinding – Mechanism of metal cutting, different cutting machines includes band saw, circular saw, reciprocating saw. Mechanism of grinding, bench grinder, surface grinding and internal grinding.
5. Drilling and tapping – Drilling machine, different parts of drilling machine and function, drill bit design and materials. Different types of taps, hand taps, solid taps.
6. Sheet bending and shearing operations – sheet bending techniques, press brake forming, sheet metal operations- punching, perforation, lacing, slitting, shearing mechanism.
7. Welding and joining processes - Shielded metal arc welding, Gas metal arc welding, Gas tungsten arc welding, Gas welding, Gas cutting, Resistance welding – spot, projection, butt welding, Soldering and Brazing.
8. Machining- working of shaper, types, different parts of shaping machine and its function- mechanism of shaping machine, different shaping operations.
9. Machining –working of lath machine, types, different parts of lath machine- headstock, tails stock and carriage, and its function, feed mechanism, different types of lath operations.
10. Machining – working of universal milling machine, types, different parts of machine and its function, milling cutters, arbors, and types milling operations.
11. Mini lathe and milling machines- Hands on experience with mini lath and milling machines.

12. CNC turning and milling- Definition of CNC, CNC program, advantages of CNC, code of program- M and G code.

Texts and References:

1. S.K. Hajara Choudhary, "Elements of workshop Technology", Vol. I, II, Asia Publishing House
2. H.S. Bawa, "Workshop Technology", Tata McGraw, Hill Publishing co. Ltd., 1995
3. W.A. J Chapman, "Workshop Technology", Edward Donald Pub. Ltd., 1961
4. V M Radhakrishnan, "Welding Technology and Design", New age international publisher, second edition, 2005

EXPERIMENTS:

First 30mins should be utilized in explaining theory part of the concerned practical and remaining time should be used for the practical demonstration and carrying out experiments. Some reading material should be given to the students pertaining to the practical and theory discussed.

- 1) Utilization of measuring instruments- Caliper, Micrometer, Dial gauge, Height gauge.
- 2) Wood working- Operations & hand tools
- 3) Cutting and grinding of metal through bench grinder & bend saw
- 4) Drilling and tapping operations for metals
- 5) Sheet Bending & hand Shearing operations for metals
- 6) Shielded Metal Arc Welding Process
- 7) Gas Metal Arc Welding Process
- 8) Gas Tungsten Arc Welding Process
- 9) Gas Welding, Gas Cutting
- 10) Resistance welding – spot, projection, butt welding
- 11) Soldering and Brazing
- 12) Demonstration of shaping operations
- 13) Demonstration of lath machine operations
- 14) Demonstration of universal milling machine operations

- 15) Hands on experience on Mini lath machine (aluminum block)
- 16) Hands on experience on Mini milling machine (aluminum block)
- 17) Demonstration of CNC- Turning operations
- 18) Demonstration of CNC- Milling operations
- 19) Industrial visit

SEMESTER 2

ESH108T MATHEMATICS – II

Lecture Hours: 3 per week

Tutorial Hour: 1 per week

Vector Differential Calculus: Scalar and vector fields, Level surfaces, Differentiation of vectors, Directional derivatives, gradient, divergence and curls and their physical meaning, vector operators and expansion formulate, Line, surface and volume integrations, Theorems of Green, Stokes and Gauss, Application of vector calculus in engineering problems, orthogonal curvilinear coordinates, expressions of gradient, divergence and curls in curvilinear coordinates.

Fourier Series: Periodic functions, Euler's formulate, Dirichlet's conditions, expansion of even and odd functions, half range Fourier series, Parseval's formula, complex form of Fourier series.

Matrix Theory: Orthogonal, Hermitian and unitary matrices, Elementary row and column transformations, rank and consistency conditions and solution of simultaneous equations, linear dependence and independence of vectors, Linear and orthogonal transformations. Eigen values and Eigen vectors, properties of Eigen values, Cayley-Hamilton theorem, reduction to normal forms, quadratic forms, reduction of quadratic forms to canonical forms, index, signature, Matrix calculus & its applications in solving differential equations.

Differential Equations: Differential equations of first order and higher degree, Linear independence and dependence of functions. Higher order differential equations with constant coefficient, Rules for finding C.F. and P.I., Method of variation of parameter, and method of undermined coefficients, Cauchy and Legendre's linear equations.

Linear differential equations of second order with variable coefficients; change of dependent variable, change of independent variable, linear equations of special types; dependent variable absent, independent variable absent. Simultaneous linear equations with constant coefficients.

Various applications of higher order differential equations in solution of engineering problems.

Partial Differential Equations: Formation of P.D.E, Equations solvable by direct integration, Linear and non-linear equations of first order, Lagrange's equations, and Charpit's method. Homogeneous and non-homogeneous linear P.D.E. with constant coefficients. Rules for finding C.F. & P.I.

Texts and References:

1. Vector Analysis by Lalji Prasad
2. Theory and problems of Advanced calculus by M.R. Spiegel (Schaum Series)
3. Theory and problems of Laplace transform by M.R. Spiegel (Schaum Series)
4. Higher Engineering Mathematics by B.V. Raman
5. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyenger.
6. A Text Book of Matrices by Shanti Narayan
7. Higher Engineering Mathematics by B. S. Grewal,
8. Advanced Engineering Mathematics – by E. Kreyszig, publication of Wiley Eastern
9. Elementary Differential Equations and Boundary Value Problems – by W.E. Boyce & R.C. DiPrima Wiley

ESH109T PHYSICS-II

Lecture Hours: 3 per week

Tutorial Hours: 1 per week

Electromagnetism:

Electromagnetic Waves Maxwell's equations, Electromagnetic waves in vacuum, wave equations for E and B, monochromatic plane waves, energy and momentum of em waves, em waves in conductors, skin depth.

Material Science and Engineering:

Atomic structure and interatomic bonding. Lattices, basic ideas of symmetry, unit cells, crystal systems, Bravais lattices. X-ray diffraction and structure determination, Structure of crystalline solids. Single crystals, polycrystalline materials, non crystalline materials. Imperfections in solids: point defects, 1D, 2D, and 3D defects. Properties of materials – mechanical, electrical, thermal, magnetic, optical, deteriorative, Classification of materials, Illustrative examples of practical uses of materials.

Advanced materials and their applications: Nano-Materials: Carbon Nano Tubes, Introduction of Lithography and soft lithography, Smart materials, Ceramics and Composite materials

Elements of thermodynamics:

Thermal equilibrium, zeroth law and concept of temperature, first law of thermodynamics and its consequences, reversible, irreversible and quasi – static processes, second law: heat engines, concept of entropy and statistical interpretation, and applications, thermodynamic potentials, Joule Kelvin effect, first order and continuous transitions, critical exponents.

High Vacuum Science and Technology:

High Vacuum Technique Nature and behaviour of gases at low pressures – Gas laws – Kinetic theory of gases – Gas flow viscous and molecular flow – Pumping speed and conductance – Measurement of pressure in vacuum systems – McLeod, thermal conductivity and ionization gauges. Production of Vacuum – Types of Pumps: Rotary and Diffusion pumps, Cryo Pumps, Ion pumps, Turbo molecular pumps.

Nuclear Science and Engineering:

Basics of Nuclear Physics, Nuclear particle detectors, activation analysis, Carbon dating, fission and fusion; principle/ design/types of nuclear reactors, effect of nuclear radiation on materials, radiation protection and environment, Neutron Scattering.

Texts and References:

1. D.J. Griffith, Introduction to Electrodynamics, Prentice Hall of India, 2007.

2. W.D. Callister, Material Science and Engineering: An Introduction John Wiley 1997
3. A Roth, Vacuum Technology, North-Holland Publishing Company, Amsterdam
4. (1976).
5. Haliday, Resnick and Krane, Physics, Vol.1 & 2 , Weiley.
6. B.B. Laud, Electromagnetism, New age International Publishers, 2nd Edition 2007
7. M.S. Vijaya and G. Rangarajan, Materials Science, Tata MvGraw Hill, 2007
8. V.V. Rao, T.B. Ghosh and K L Chopra, Vacuum Science and Technology, Allied
9. Publishers Ltd., New Delhi (1998).
10. Nuclear Science and Engineering, Addison Wesley Publishing Company, 1962.

ESH109P Physics-II Laboratory Experiments

Sr.No.	Name of Experiment
1	Critical point (phase change)
2	Dielectric Constant
3	Four probe Resistivity method
4	To determine Thermal conductivity of building blocks
5	To determine thermal co-efficient of expansion of solid
6	To determine specific heat of solid
7	Heat engine
8	B-H loop of a ferromagnetic material
9	Pirani and Penny Gauges
10	Measurement of thickness of thin films
11	GM counter
12	Kerr- effect
	Other experiments of vacuum science and electromagnetism, thermodynamics, and material science.

PET 102T PETROLEUM CHEMISTRY

Lecture Hours: 2 per week

Crude oil and Natural Gas: Introduction, origin of Petroleum, Modern Concept of Formation of Petroleum, Composition and Terminology of Petroleum, Classification of Petroleum, Petroleum Products from Crude Oil.

Characterization and Analytical Techniques for Crude Oil: Physical properties, Thermal properties, Electrical properties, Optical properties, Chromatographic techniques, Spectroscopic methods (Principles and Applications of UV Visible, IR, and NMR Spectroscopy), Characterization of formation water.

Processing and Refining of crude oil: Distillation, Sweetening and Cracking (basic concepts), Reforming, Isomerization, Alkylation processes, Polymerization processes, Solvent process, Knocking, Octane number and Cetane number, Additives to improve the quality of Diesel and Petrol, Catalysis and Applications of Catalysts (like Zeolite and other catalysts) in separation processes and also in petroleum industries.

Coal Chemistry: Structure of coal, Effect of heat on coal, Carbonization and pyrolysis, Recovery and purification of by-products obtained from coke ovens, Distillation of coal tar, Coal chemicals

Environmental issues of refining: Environmental regulations, Amendments and Acts like clean air act amendments, clean water act, safe drinking water act, resource conservation and recovery act, oil pollution act.

Texts and References:

1. The Chemistry and Technology of Petroleum, James G Speight, 5th Edition, CRC Press, New York, 2010
2. Crude Oil Chemistry, Vasily Simanzhenkov, Raphael Idem, Marcel Dekker, Inc,

PET 102P PETROLEUM CHEMISTRY LAB

Practical Hours: 2 per week

LIST OF EXPERIMENTS (minimum 10 experiments from the list given below based on the course content should be done in a semester):

1. Determination of hydrocarbon groups in Petroleum fractions by method of sulphuric acid treatment.
2. Determination of hydrocarbon group composition in petroleum fractions by method of Fluorescent indicator Adsorption Technique.
3. Estimation of percent aromatic hydrocarbons by Aniline point method.
4. Estimation of sulphur content and calorific value of petroleum fraction by Bomb calorimeter.
5. Estimation of percent C and H contents in petroleum fractions.
6. Study of etherification reactions by using dil.HCL, dil H₂SO₄ as catalyst.
7. Determination of Bromine Number.
8. Estimation of Molecular Weight.
9. Estimation of surface area of catalyst by BET method.

10. Determination of specific gravity of powder sample.
11. Determination of Density and specific gravity of petroleum products.
12. Determination of viscosity of petroleum products by Ostwald viscometer.
13. Determination of correlation index of hydrocarbon.
14. Determination of Viscosity-Gravity Constant (VGC) of petroleum products.
15. Determination of Universal Oil Product (UOP) characterization factor.
16. Determination of wax in crude oil.

PET 103T ENGINEERING THERMODYNAMICS

Lecture Hours: 2 per week

Review of the first and second laws of thermodynamics and basic concepts of heat and work.

Zeroth and Third and laws of thermodynamics

Thermodynamic cycles: introduction to Carnot cycle, Rankine cycle, Otto cycle, Diesel cycle, Brayton cycle

Refrigeration: basic concepts; introduction to vapor compression cycle, vapor absorption cycle

Conservation of Mass and Energy - general balance equation and conserved quantities. conservation of mass and energy. thermodynamic properties of matter. applications of mass and energy balances. conservation of momentum.

The Thermodynamic Properties of Real Substances - ideal gas; absolute temperature scales; the evaluation of thermodynamic partial derivatives, the evaluation of changes in the thermodynamic properties of real substances accompanying a change of state; the principle of corresponding states; generalized equations of state.

Equilibrium and Stability in One Component Systems - the criterion for equilibrium; stability of thermodynamic systems; phase equilibria; application of the equilibrium and stability criterion to the equation of state. Gibbs free energy and the concept of chemical potential.

Phase Equilibria - the molar Gibbs free energy and fugacity of a pure component; calculation of pure fluid phase equilibrium; the computation of vapor pressure from an equation of state. specification of the equilibrium; effect of pressure and temperature on phase equilibrium.

Phase Rule - thermodynamic state of a system of several phases; the Gibbs phase rule for a one component system; thermodynamic properties of phase transitions.

Texts and References:

1. S. I. Sandler. "Chemical Engineering Thermodynamics", Wiley, New York, 1999.
2. J. M. Smith and H. C. Van Ness "Introduction to Chemical Engineering Thermodynamics" 4th ed. McGraw Hill, 1987.
3. Y. V. C. Rao, "Chemical Engineering Thermodynamics", University Press 1997
4. P. K. Nag Engineering Thermodynamics, Tata McGraw-Hill, New Delhi
5. Yunus Cengel & Boles, Thermodynamics- An Engineering Approach, Tata McGraw-Hill, New Delhi
6. Sonntag, Borgnakke & van wylen, Fundamentals of thermodynamics John Wiley & sons (ASIA) Pvt ltd.

ESH110T ENGINEERING MECHANICS

Lecture Hours: 3 per week

Tutorial Hour: 1 per week

Fundamental of Statics:

Principles of statics, coplanar, concurrent and non-concurrent, parallel and non parallel forces, composition and resolution of forces, moments and couples-their properties. Combination of coplanar couples and forces, equilibrant, equilibrium, free body diagrams, analytical conditions of equilibrium of coplanar force systems.

Truss:

Simple determinate plane trusses and analysis for member forces using methods of joints and methods of sections..

Laws of friction:

Wedge, inclined plane, screw and screw jack, Belt friction, collar friction

Distributed forces, center of gravity and moment of inertia:

Center of gravity of different sections used in engineering, Moment of inertia of plane figures, polar moment of inertia, moment of inertia of rigid bodies, laminate and composite sections

Virtual work and potential energy principles:

Application of these principles as replacement of equation of statics for real life problems

Kinetics of particles:

D' Alembert's principle for translation and curvilinear motion, work and energy methods related to engineering systems, Linear motion, circular motion, rotation and translation, displacement, velocity and acceleration time diagrams.

Vibrations:

Mechanical vibration of single degree of freedom system

Texts and References:

1. Vector Mechanics for Engineers: Statics and Dynamics by Ferdinand P. Beer & E. Russell Johnston, McGraw-Hill Science
2. Applied Mechanics by S. B. Junarkar & H J Shah Charutar Publishing House, Anand
3. D.J. McGill and W.W. King, *Engineering Mechanics: an Introduction to Dynamics, Third edition, PWS Publishing.*
4. J.L. Meriam and L.G. Kraige, *Engineering Mechanics: Dynamics, Fourth edition, Wiley.*
5. W.F. Riley and L.D. Sturges, *Engineering Mechanics: Dynamics, Second edition, Wiley.*
6. A. Bedford and W. Fowler, *Engineering Mechanics: Dynamics, Addison-Wesley.*

ESH111T ENGINEERING GRAPHICS

Lecture Hour: 1 per week

CAD Software:

Introduction to Solid Edge software

Introduction to

Drawing instruments and their uses, Indian standards for drawing; Lettering, Lines and dimensioning, Scales.

Orthographic projections:

First angle and third angle projections, Orthographic projections of simple solids, Drawing 2-D views from given Isometric drawings.

Isometric projections:

Isometric projections of simple solids, isometric views, conversion of orthographic views to isometric views; free hand sketches

Projection of points, straight lines and planes:

Line inclined to both the reference planes, Plane inclined to both the planes limited to triangular, quadrilateral, pentagonal, hexagonal and circular planes

Projections of solids & section of solids:

Classifications of solids, Projections of solids to various planes and true shapes of sectioned surface, surface development of solids and its uses.

Texts and References:

1. A text book of Engineering Graphics By P. J. Shah, S. Chand & Company Ltd, New Delhi
2. Engineering Drawing By N. D. Bhatt, Charutar Publishing House, Anand
3. Engineering Drawing and Graphics with AutoCAD by K. Venugopal
4. Fundamentals of Engineering Drawing (with an introduction to interactive computer graphics for design & production By Warren J. Luzadder & Jon M. Duff, PHI
5. Introduction to Engineering Drawing & Auto CAD, NIIT, PHI
6. A text book of Engineering Drawing By P. S. Gill, S. K. Kataria & sons, Delhi

ESH111P ENGINEERING GRAPHICS LABORATORY

Practical Hours: 2 per week

1. Learning of the following Solid works DWG editor Commands:
Line, polygon, Rectangle, Arc, Circle, Spline, Ellipse
Copy, mirror, offset, array, rotate, scale, hatch, extend, break, chamfer, fillet
Dimensioning, Pan, zoom
2. Projection of lines (in sketch book)

3. Projection of planes (in sketch book)
4. Free hand sketches on sketching paper with rectangular grids
5. Orthographic projections (on sketching paper with rectangular grids/using Solid Works software tool)
6. Sectional orthographic projections (on sketching paper with rectangular grids/using Solid Works software tool)
7. Isometric projections (on sketching paper with rectangular grids/using Solid Works software tool)
8. Development of surfaces (on sketching paper with rectangular grids/using Solid Works software tool)
9. Projections of solids (on sketching paper with rectangular grids/using Solid Works software tool)
10. Interpenetration of solids (on sketching paper with rectangular grids/using Solid Works software tool)

NOTE: Topic no. 1 is requires at least **5** sessions.

Elective Courses of B. Tech (old):

ELECTIVE: ES 212 CORROSION IN PETROLEUM INDUSTRY AND ITS CONTROL

Lecture Hours: 2 per week

Course content:

Introduction: Definition, Economic losses and damages in corrosion, Corrosion principles-electrochemical aspects, Corrosion mechanism- Basic corrosion cells, Polarization, Passivity, Theories of Corrosion.

Causes and types of Corrosion: Factors affecting corrosion with respect to nature of metal and environment, Uniform attack, Galvanic corrosion, Pitting corrosion, Erosion corrosion, Stress corrosion.

Corrosion in Petroleum industry: Corrosion in Petroleum production, Corrosion in transport and storage, Corrosion in refining operations, Corrosion in offshore production

Corrosion testing techniques: Purpose of corrosion testing, Materials and specimens, Surface preparation, Testing for corrosion types like electrochemical, HT/HP, galvanic, sea water, Slow strain rate test e.t.c

Corrosion control: Material selection and design, Protective coating, Cathodic and anodic protection, Corrosion inhibitor

Corrosion control in Industry Environment: Anti Corrosion management, environment and Quality at the refining industry

Texts and References:

1. Mars G. Fontana "Corrosion Engineering" Tata McGraw-Hill, Third Edition.
2. Baldev Raj, U.Kamachi Mudali, S.Ranagarajan "Corrosion Prevention and Control" Narosa Publishing House Pvt. Ltd.
3. B.S.Chauhan, "Comprehensive Engineering Chemistry" Galgotia Publications Pvt.Ltd

ELECTIVE: ES 213 MATERIALS FOR OIL AND GAS INDUSTRY

Lecture Hours: 2 per week

Introduction to materials – Types, Ferrous- Steels, Stainless Steels, Non Ferrous-Nickel, Titanium, Aluminum and Copper base alloys. Nonmetallic and polymeric material, different standards such as API, ISO, ASTM, NACE etc.

Structure property relations for different materials

Materials for Drill Bit - Types of drill bits, inserts includes; WC-Co, Double carbide, Diamond enhance bits; PDC drill bits, PDC cutter, Rock and bit interaction (hole deviation)

Materials for Drill String - Issue with drill string materials and practices, Materials for Drill Pipe- Drill pipe for normal and sour service, Materials for drill collar, reamers and Kelley.

Materials for Casing and Tubing - Properties of casing and Tubing, API/Non-API grades,API/ISO tubing requirements, Resin composites for oil tubing, High strength coil tubing, QT-16Cr coil tubing.

Materials for drill rig structure - Derricks, Masts, Substructure, Material selection for surface, offshore and deep water wellhead applications, Materials for High Pressure High Temperature (HPHT) Wells

Materials for pipelines sweet and sour service - Transportation, Subsea, Cross country.

Corrosion Resistance Alloys (CRA- Ferrous)- Use of carbon steel in highly sour oil and gas production system. Corrosion Resistance Alloys (CRA- Non Ferrous)- High performance CRA Nickel alloys

Important material related issues - Hydrogen sulfide stress corrosion cracking (HSSC)

Hydrogen embrittlement, Corrosion in oil and gas environment including SCC, Weld corrosion, H₂S resistance materials

Texts and References:

1. Petroleum engineering handbook, Vol. II (Ch.5)
2. Bruce D. Craig, 'Selection guidelines for corrosion resistant alloys in the oil and gas industry', Materials for oil and gas industry, pp 1-11.
3. Anthony Griffo, 'Oil and gas drilling materials', Advance Materials and Processes, June 2003.
4. Matthew Yao and James Wu, ' Balance of alloying elements in wear resistant CO-based alloys for oil drilling applications' Paper no 8086, NACE Corrosion 2008.
5. Manul N Maligas, 'Material selection for deep water wellhead applications', Paper no 1001, NACE Corrosion 2001.
6. L M Smith, 'Ensuring corrosion properties of CRA welds meet requirements for oil and gas industry', paper no. 3091, NACE Corrosion 2003.

MA312 TIME SERIES ANALYSIS (Elective Course)

Lecture Hours: 2 per week

Introduction: Examples, simple descriptive techniques, trend, seasonality, the correlogram.

Probability models for time series: stationarity. Moving average (MA), Autoregressive (AR), ARMA and ARIMA models. Estimating the autocorrelation function and fitting ARIMA models.

Forecasting: Exponential smoothing, Forecasting from ARIMA models. **Stationary processes in the frequency domain:** The spectral density function, the periodogram, spectral analysis.

State-space models: Dynamic linear models and the Kalman filter.

Introduction to Wavelets: Discrete wavelet transform, Haar and Daubechies wavelets.

Introduction to multivariate analysis: Principal Component Analysis.

Texts and References:

1. Chris Chatfield, "The Analysis of Time Series: An Introduction", 6th edition, Chapman and Hall / CRC, 2003.
2. Christopher Chatfield and Alexander J. Collins, "Introduction To Multivariate Analysis", Revised Edition, Chapman & Hall/CRC Press, 2000.
3. William Wei, "Time Series Analysis: Univariate and Multivariate Methods", 2nd edition, Pearson/Addison Wesley, 2006.
4. R. H. Shumway and D. S. Stoffer, "Time Series Analysis and Its Applications: With R Examples", 2nd edition, , 2006.
5. James D. Hamilton, "Time Series Analysis", Princeton, NJ: Princeton University Press, 1994.