B.E.II/ IV NAVAL ARCHITECTURE AND MARINE ENGINEERING
(I-SEMESTER)

* NAM 211 - MATHEMATICS – III

Periods/week : 3 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits:4

(Common with Mechanical Engineering.)

Vector Calculus: Differentiation of vectors, Curves in space, Velocity and acceleration, Relative velocity and acceleration, Scalar and vector point functions - Vector operator del. Del applied to scalar point functions - Gradient, Del applied to vector point functions - Divergence and Curl. Physical interpretations of div F and Curl F Del applied twice to point functions, Del applied to products of point functions, Integration of vectors, Line integral - Circulation - Work Surface integral - Flux, Green's theorem in the plane, Stoke's theorem, Volume integral , Divergence theorem, Irrotational and Solenoidal fields, Green's theorem, Orthogonal curvilinear co-ordinates Del applied to functions in orthogonal curvilinear co-ordinates, Cylindrical co-ordinates - Spherical polar co-ordinates.

Partial Differential Equations: Formation of partial differential equations, Solutions of a partial differential equation, Equations solvable by direct integration. Linear equations of the first order, Homogeneous linear equations with constant coefficients, Rules for finding the complementary function, Rules for finding the particular integral, Working procedure to solve homogeneous linear equations of any order, Non-homogeneous linear equations.

Applications of Partial Differential Equations: Introduction, Method of separation of variables, partial differential equations of engineering, Vibrations of a stretched string - Wave equation, One-dimensional heat flow, Two dimensional heat flow, Solution of Laplace's equation, Laplace's equation in polar co-ordinates.

Integral Transforms: Introduction, Definition, Fourier integrals- Fourier sine and cosine integrals- Complex forms of Fourier integral, Fourier transform- Fourier sine and cosine transforms- Finite Fourier sine and cosine transforms, Properties of F-transforms, Convolutions theorem for F-transforms, Parseval's identity for F-transforms, Relation between Fourier and Laplace transforms, Fourier transforms of the derivatives of a function, Inverse Laplace transforms by method of residues, Application of transforms to boundary value problems.

Text Books:

1. Higher Engineering Mathematics, by Dr.B.S.Grewal,Khanna Publishers, New Delhi-110 006. 34 edition, 1998.

References:

1. A Text Book on Engineering Mathematics, by N.P. Bali et al, Laxmi Publications (P) Ltd. New Delhi-110 002.
2. Higher Engineering Mathematics, by Dr. M.K. Venkataraman, National Pub. Co. , Chennai – 600 001.
3. Advanced Mathematics for Engineering Students, Vol.2 & Vol.3 by Narayanan, Manicavachagom Pillay and Ramanaiah.
4. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley Eastern Pvt. Ltd., New Delhi-49.
5. Engineering Mathematics by P.P.Gupta,Krishna Prakasham Media (P) Ltd. Meerut Vol-2.
6. Advanced Engineering Maths by V.P.Jaggi and A.B.Mathur, Khanna Pub. New Delhi-6.
7. Engineering Mathematics S.S.Sastry,Printice-Hall of India, Pvt. Ltd. New Delhi-1.
8. Advanced Engineering Mathematics by Prof.H.K.Dass, S.Chand and Co Ltd, N. Delhi -1

NAM 212: Engineering Mechanics - I: (Statics)

Periods/week : 5 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits:4

1. General Principles

Fundamental concepts, Units of Measurement, SI Units

2. Force Vectors.

Vector Operations, vector addition of forces, Coplanar forces, Cartesian vectors, Position vectors, Force vector directed along a line, dot product

3. Equilibrium of a Particle

Condition for the equilibrium of a particle, coplanar force system, Three-dimensional force systems

4. Force System Resultants

Moment of a force, scalar and vector formulation, principle of moments, moment of a force about a specified axis, moment of a couple, equivalent system, resultants of a force and couple system, further reduction of force and couple systems, distributed loading

5. Equilibrium of a Rigid Body

Conditions for equilibrium of a rigid body, free body diagrams, equations of equilibrium, two and three force members, equilibrium in 3-D, constrainst for a rigid body

6. Structural Analysis

Simple Trusses, method of joints, zero force members, method of sections, space trusses, frames and machines

7. Friction

Characteristics of dry friction, problems involving dry friction, wedges, screws, flat belts

8. Center of Gravity and Centroid

Centre of gravity, centre of mass, centroid, composite boides, pappus Guldinus theorem, distributed loading resultants.

9. Moments of Inertia

MI, parallel axis theorem, mI of area by integration, MI of composite areas, product of inertia, Mass MI

10. Virtual Work

Principle of VW for particle and rigid body, and system of connected bodies, conservative forces, PE, PE criterion for equilibrium, stability of equilibrium

Textbook:

R C Hibbeler, Ashok Gupta, "Engineering Mechanics – Statics and Dynamics," Pearson Education

References:

1. *Vector Mechanics for Engineers: Statics and Dynamics*, by Ferdinand P. Beer & E. Russell Johnston Jr., Mc Graw Hill
2. *Engineering Mechanics* by S. P. Timoshenko and D.H.Young, Mc.Graw-Hill.
3. *Engineering Mechanics Statics and Dynamics* 4th ed Irving H Shames, Prentice Hall

NAM 213 - Mechanics of solids-I

Periods/week : 5 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits:4

1. General concepts: stress,strain,lateral strain, stress-strain diagram.Generalisation of Hooke's law.Temperature stresses.Stresses in axially loaded bars.Strain energy Impact loads.Relation between elastic constants.
2. Stress transformation : Transformation of stresses in 2-D problems.Principal stresses in 2-d problems.Maximun shear stresses in 2-d problems.Mohr's circle for stress transformation and principal stresses.
3. Bending moments and shear forces : Types of beams, Types of loads ,Types of supports .S.F. and B.M. diagrams for statically determinate beams.Relation between bending moment , shear stress and intensity of loading.
4. Stresses in beams : Simple theory of bending, Flexural formula, Shear stress in beams.Principal stresses in beams.Strain energy due to bending.
5. Deflection of beams : Relation between curvature , slope and deflection.Double integration method ,Macaulay's method ,Moment area method.
6. Tortional stresses in shafts : Analysis of tortional stresses , power transmitted by circular shafts. Combined bending and tortion .Principal stresses in shafts.Strain energy due to twisting.
7. Closed and opened coiled helical springs : Analysis,principal stresses in open coiled helical springs.
8. Thin walled cylindrical and spherical vessels : Stresses and strains .Analysis.

Text Books :

Engineering mechanics of solids by E.P.Popov,second edition ,PHI.

Reference :

1. Mechanics of solids by R.C.Hibbler.
2. Analysis of structures by Vazairani and Ratwani Vol 1,1993 edition.

NAM 214 – ENGINEERING THERMODYNAMICS - I

Periods/week : 5 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits: 4

Introduction- Basic concepts- Thermodynamic systems, Micro & Macro systems- Homogeneous and heterogeneous systems- Concept of continuum- Pure substance- Thermodynamic equilibrium, State Property, Path, Process- Reversible and irreversible cycles- Energy as a property of the systems- Energy in state and transition, Work, Heat, Point function, Path function- Heat transfer.

Zeroth law of thermodynamics- Concept of equality of temperatures- Joule's experiments- First law of thermodynamics- Corollaries- Isolated systems and steady flow systems- Specific heats at constant volume and pressure- First law applied to flow systems- Systems undergoing a cycle and change of state- First law applied to steady flow processes- Limitations of first law of thermodynamics.

Perfect gas laws- Equation of state- Universal gas constant, various non-flow processes- Heat transfer and work transfer- Change in internal energy- throttling and free expansion-

Second law of thermodynamics- Kelvin Plank statement and Classius statement and their equivalence, Corollaries- Perpetual motion machines of first kind and second kind- Reversibility and irreversibility- Cause of irreversibility- Carnot cycle- Heat engines and heat pumps- Carnet efficiency- Classius theorem- Classius inequality- Concept of entropy- Principles of increase of entropy- Entropy and disorder.

Availability and irreversibility- Helmholtz function and Gibbs function- Availability in steady flow- Entropy equation for flow process- Maxwell's equations- Tds relations- Heat capacities.

Properties of steam and use of steam tables- Measurement of dryness fraction- T-S and H-S diagrams.

Vapor Power Cycles: Vapor power cycle- Rankine cycle- Reheat cycle- Regenerative cycle- Thermodynamic variables effecting efficiency and output of Rakine and Regenerative cycles- Improvements of efficiency. Binary vapor power cycle.

Steam Nozzles: Type of nozzles- Flow through nozzles- Condition for maximum discharge- Nozzle efficiency- Super saturated flow in nozzles- Relationship between area velocity and pressure in nozzle flow- Steam injectors.

Steam Turbines: Classification of steam turbines- Impulse turbine and reaction turbine- Compounding in turbines- Velocity diagrams in impulse and reaction turbines- Degree of reaction- Condition for maximum efficiency of reaction turbines- Effect of friction on turbines constructional features governing of turbines.

Condensers: Classification of condenser- Jet and surface condensers- Vacuum and its measurement- Vacuum efficiency- Sources of air leakage in condensers- Condenser efficiency- Daltons law of partial pressures- Determination of mass of cooling water- Air pumps.

Text Books:

1. Engineering Thermodynamics, by P.K.Nag, Tata McGraw Hill Publications company.
2. Thermodynamics (SI Version) by William Z Black & James G Hartley
3. Thermal Engineering, by M.L.Mathur and F.S.Mehta, Jain Brothers.

References:

1. Thermodynamics, by Spolding and Cole.
2. Engineering Thermodynamics Work and Heat Transfer, by G.F.C.Rogers and Y.R.Mayhew, ELBS publication.
3. Fundamentals of Engineering Thermodynamics By E Radhakrishnan
4. Engineering Thermodynamics by Zemansky.

NAM 215 – THEORY OF SHIPS

Periods/week : 5 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits: 4

Introduction: Ship, Archimedes principle, principles of flotation , types of ships, nomenclature and geometry. Lines plan, and fairing of lines, displacement and tonnage, TPC, coefficients of forms, wetted surface area. Calculation of area, volume, and first and second moments using Simpson's rule, center of gravity, effect of addition of mass, movement of mass and suspended mass.

Stability of ships and freeboard: Transverse stability of ships, statical stability at small angles of heel, calculation of BM, metacentric diagram, free surface effect, Inclining experiment, Bonjean curves, hydrostatic curves. Stability at large angles: Statical Stability Curve, angle of loll, wall sided formula, cross curves of stability, (graphical and numerical methods), polar diagrams, metacentric evolute, particular cases of righting moment, dynamical stability, stability diagrams, effects of external heeling moments, stability criteria.
Trim and effects of changes in draught. Free board, Different types of free board, ships types based on free board, ILLC requirements, free board calculations.

Subdivision of ships: Causes and types flooding, volume and surface permeability due to bilging of side compartments. Added weight and buoyancy, methods of calculation, subdivision load lines, margin line, floodable length, permissible length, criteria of service numeral, floodable length curves.

Freeboard, tonnage capacities.

Launching: Launching arrangement, end launching, side launching, launching calculations, docking and grounding.

Hazards and protection: Rules and Regulations, SOLAS regulations for subdivision and damage stability for passenger ship. Damage stability requirements of cargo ships. IMO regulations on Damage stability & Hazards and Protection. Grain loading, ship building materials.

General layout of ships: Layout of main and other decks, disposition of bulkheads and decks, types of main engines, engine room layout, electrical systems for ships.

Ship structure: General mid ship section structural arrangements for different types of ships, structural layout of general cargo ship, oil tanker, and bulk carrier. Structural members of a ship.

Accommodation in ships: Design philosophy, living spaces, commissioning spaces, spaces for dining, recreation, services etc. Indian merchant shipping rules and regulations for crew accommodation, accommodation construction using panels, bulkheads, ceiling etc. Insulation of accommodation. Different classification societies, and rules of IRS, LRS, ABS, BV, DNV etc. STCW code and ISM code.

Life saving appliances and navigational aids: Primary and secondary types of life saving equipment, requirements for various ships, navigational aids for ship, communication equipment, navigational lights, conventions and rules regarding lights, shapes and sound signals.

Shipyard layout: Various departments and workshops in a shipyard, facilities and services. Elementary steps in ship construction. Material preparation, structural assembly, hull construction, launching, outfitting. Hull protection methods. Surface preparation and paintings.
Tonnage measurement: Measurement and calculations of tonnage national, Suez Canal and panama canal rules.

Text books:
1.Reeds Naval Architecture
2. Principles of Naval Architecture by J.P.Comstock
References:
1.Principles of Naval Architecture by Ed.V.Lewis
2.Ship Stability for Masters and Mates by D.R.Derrick.
3.Basic Ship Theory by K.J.Rawson & E.C.Tupper

NAM 216 - Ship Drawing – I

Periods/week : 6 Ses. : 100
Credits: 4

Lines plan :Delineation of lines plan. Drawing of lines plan. Drawing instruments and other equipment uses. Drawing of ship lines from basic Naval Arch Principles. Drawing of ship lines using series data. Special features and characteristics of ship lines. Mathematical representation of ship lines. Computer aided drawing and design. Use of scales and fairing of ship lines. Capacity calculations, capacity plan, scales, Bonjean curves, sectional area curves and their properties.

Practical: Lines plan, capacity plan, Bonjean curves, sectional area curves, special features of ship drawing tables, paper, area curves, tracing paper, pencil drawing and ink tracing techniques. Drawing of curved lines with battens, types of battens. Dos and Don'ts while using battens. Use of French curves and paper strips for fairing lines.

Hydrostatic calculations: Calculation of hydrostatic properties of ships, displacement sheet, appendage corrections, plotting of hydrostatics, scales. Relationship if any between various hydrostatic curves, practical use of hydrostatic curves for transverse and longitudinal stability calculations.

Practical: Calculation and plotting of hydrostatic curves.

Stability and trim: Transverse and longitudinal stability and trim calculations, effects of movement of liquids, cargo, fuel, fresh water, grain, rules for stability. Calculations and plotting of cross curves, G-Z curves. Stability booklet for ships, DWT scale, cargo loading and unloading, Ballasting and deballasting. Inclining equipment, Calculation and estimation of GM in different service conditions. Weight calculations. Introduction and importance of weight calculations in ship design and construction. Calculation of weights of plates and sections, weight calculation data. Detailed estimation of steel weight of ships hull. Calculation of LCG and VCG of ship and off-centerline moments of ship. Calculation of total weight of the ship based on group weights. Calculation of centroid of sections and plates and other structural elements.

Practical: Drawing of Stability Curves, Analysis of inclining experiment and weight calculations, LCG and VCG calculation.

Lofting and loft work: Lofting and Loft work, removal of scale errors, preparation of templates for ship construction. Laying of development of surfaces with single and double curvature of surfaces and shell plates. Marking of frame lines both longitudinal and transverse.

Practical: : Drawing of a developed surface. Preparation of a template

Sub division of ships: Water Tight subdivision of ships, standards, SOLAS. Classification rules. Definitions, marginal lines, criterion of service, factor of subdivision, permeability, floodable length, permissible length, flooding and damaged stability calculations. Freeboard and tonnage calculations and markings, rules, regulations, ILLC, importance of plimsoll markings, and draughts class A, Class B Ships. Introduction to Computer aided ship calculations and drawings.

Practical: Floodable length calculations and plotting of floodable length and permissible length curves. Freeboard and tonnage calculations.

NAM 217 – STRENGTH OF MATERIALS LAB

Periods/week : 3 Ses. : 50 Exam : 50
Examination Practical: 3hrs. Credits: 2

List of Experiments:

1. To study the stress strain characteristics (tension and compression) of metals by using UTM.
2. To study the stress strain characteristics of metals by using Hounsefield Tensometer.
3. Determination of compression strength of wood.
4. Determination of hardness using different hardness testing machines- Brinnels, Vickers and Rockwell's.
5. Impact test by using Izod and Charpy methods.
6. Deflection test on beams using UTM.
7. Tension shear test on M.S. Rods.
8. To find stiffness and modulus of rigidity by conducting compression tests on springs.
9. Torsion tests on circular shafts.
10. Bulking of sand.
11. Punch shear test, hardness test and compression test by using Hounsefield tensometer.
12. Sieve Analysis and determination of fineness number.

NAM 218 – WORKSHOP PRACTICE – II

Periods/week : 3 Ses. : 50 Exam : 50
Examination Practical: 3hrs. Credits: 2

Not less than 10 exercises in the following trades:

1) Arc Welding and Gas Welding
2) Pipe Joints and Fitting
3) Machine Shop (Lathe, Drilling, Shaping, Etc.)

B.E. II / IV - NAVAL ARCHITECTURE AND MARINE ENGINEERING (II-SEMESTER)

* NAM 221 – MATHEMATICS – IV

Periods/week : 3	Ses. : 30	Exam : 70
Examination Theory: 3hrs.	Credits: 4	

(Common with Mechanical Engineering)

Functions of a complex variable: Introduction f(z) its limit and continuity, Derivative of f(z) - Cauchy-Riemann equations, Analytic functions, Harmonic functions - Orthogonal system, Applications to flow problems, Integration of complex functions, Cauchy's inequality, Liouville's theorem, Poisson's integral formulae Series of complex terms - Taylor's series - Laurent's series, Singular points - Residues, Residue theorem, Calculation of residues Evaluation of real definite integrals, Geometrical representations, Special conformal transformations.

Statistical Methods: Probability, Addition law of probability, Independent events, Multiplication law of probability distribution, Continuous probability distribution, Expectation, Moment generating function, Repeated trials, Binomial distribution, Poisson distribution, Normal distribution, Probable error, Normal approximation to Binomial distribution, Some other distributions, Sampling, Sampling distribution, Standard error, Testing of hypothesis, Level of significance, Confidence limits, Simple sampling of attributes, Sampling of variables - Large samples, Sampling of variables - Small samples, Student's t-distribution, x -distribution, F-distribution, Fisher's Z-distribution.

Difference Equations and Z-Transforms: Z-transform-Definition, Some standard Z-transforms, Linear property, Damping rule, Some standard results, Shifting rules, Initial and final value theorems, Convolution theorem, Evaluation of inverse transforms, Definition, Order and Solution of a difference equation, Formation of difference equations, Linear difference equations, Rule for finding C.F., Rules for finding P.I., Difference equations reducible to linear form, Simultaneous difference equations with constant coefficients, Applications to deflection of a loaded string, Application of Z-transform to difference equations.

Text Book Scope as given in:

1. Higher Engineering Mathematics, by Dr.B.S.Grewal, Khanna Publishers, 34th edition, 1998, New Delhi-110 006.

Reference Books:

1. A Text Book on Engineering Mathematics, by N.P.Bali Etal, Laxmi Publications (P) Ltd. New Delhi-110 002.
2. Higher Engineering Mathematics by Dr. M.k.Venkataraman, National Pub. Co,Madras-1.
3. Advance Mathematics for Engg. Students, Vol.2 & vol.3 by Naryanan, Manicavachagam Pillay and Ramanaiah.
4. Advanced Engg. Maths. by Erwin Kreyszig, Wiley Eastern Pvt. Ltd. New Delhi-49.
5. Engg. Maths, by P.P.Gupta, Krishna Prakasham, Vol 2, Media (P) Ltd. Meerut .
6. Advanced Engg. Maths by V.P.Jaggi and A.B.Mathur, Khanna Pub. New Delhi-6.
7. Engg. Maths, by S.S.Sastry, Printice-Hall of India, Pvt.Ltd. New Delhi- 110 006.
8. Advanced Engineering Mathematics by Prof.H.K.Dass, S.Chand & Co. Ltd. New Delhi-51.
9. EngineeringMathematics Vol.2 by Tarit Majumdar, New Central Book agency (P) Ltd., Calcutta-9.

NAM 222 - ENGINEERING MECHANICS - II

Periods/week : 5	Ses. : 30	Exam : 70
Examination Theory: 3hrs.	Credits: 4	

1. Kinematics of a Particle

Introduction. Rectilinear Kinematics: Continuous Motion. Rectilinear Kinematics: Erratic Motion. General Curvilinear Motion. Curvilinear Motion: Rectangular Components. Motion of a Projectile. Curvilinear Motion: Normal and Tangential Components. Curvilinear Motion: Cylindrical Components. Absolute Dependent Motion Analysis of Two Particles. Relative-Motion Analysis of Two Particles Using Translating Axes.

2. Kinetics of a Particle: Force and Acceleration

Newton's Laws of Motion. The Equation of Motion. Equation of Motion for a System of Particles. Equations of Motion: Rectangular Coordinates. Equations of Motion: Normal and Tangential Coordinates. Equations of Motion: Cylindrical Coordinates. Central-Force Motion and Space Mechanics.

3. Kinetics of a Particle: Work and Energy

The Work of a Force. Principle of Work and Energy. Principle of Work and Energy for a System of Particles. Power and Efficiency. Conservative Forces and Potential Energy. Conservation of Energy

4. Kinetics of a Particle: Impulse and Momentum

Principle of Linear Impulse and Momentum. Principle of Linear Impulse and Momentum for a System of Particles. Conservation of Linear Momentum for a System of Particles. Impact. Angular Momentum. Relation Between Moment of a Force and Angular Momentum. Angular Impulse and Momentum Principles. Steady Fluid Streams. Propulsion with Variable Mass.

5. Planar Kinematics of a Rigid Body

Rigid-Body Motion. Translation. Rotation About a Fixed Axis. Absolute General Plane Motion Analysis. Relative-Motion Analysis: Velocity. Instantaneous Center of Zero Velocity. Relative-Motion Analysis: Acceleration. Relative-Motion Analysis Using Rotating Axes.

6. Planar Kinetics of a Rigid Body: Force and Acceleration

Moment of Inertia. Planar Kinetic Equations of Motion. Equations of Motion: Translation. Equations of Motion: Rotation About a Fixed Axis. Equations of Motion: General Plane Motion.

7. Planar Kinetics of a Rigid Body: Work and Energy

Kinetic Energy. The Work of a Force. The Work of a Couple. Principle of Work and Energy. Conservation of Energy.

8. Planar Kinetics of a Rigid Body: Impulse and Momentum

Linear and Angular Momentum. Principle of Impulse and Momentum. Conservation of Momentum. Eccentric Impact.

Textbook:

R C Hibbeler, Ashok Gupta, "Engineering Mechanics – Statics and Dynamics," 11th Edition, Pearson Education

References:

1. *Vector Mechanics for Engineers: Statics and Dynamics*, by Ferdinand P. Beer & E. Russell Johnston Jr., Mc Graw Hill
2. *Engineering Mechanics* by S. P. Timoshenko and D.H.Young, Mc.Graw-Hill.
3. *Engineering Mechanics Statics and Dynamics* 4th ed Irving H Shames, Prentice Hall

* NAM 223 - ENVIRONMENTAL SCIENCES

Periods/week : 5 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits: 4

(Common with Mechanical Engineering)

Module 1 : Introduction

Definition, scope and importance
Measuring and defining environmental development : indicators

(1 Lecture)

Module 2 : Ecosystems

Introduction, types, characteristics features, structure and functions of Ecosystems

- Forest
- Grassland
- Desert
- Aquatic (lakes, rivers, and estuaries)

(2 Lectures)

Module 3 : Environment and Natural Resources Management

Land resources

- Land as a resource
- Common property resources
- Land degradation
- Soil erosion and desertification
- Effects of modern agriculture, fertilizer-pesticide problems

Forest resources

- Use and over-exploitation
- Mining and dams-their effects on forest and tribal people

Water resources

- Use and over-utilization of surface and ground water
- Floods, draughts
- Water logging and salinity
- Dams-benefits and costs
- Conflicts over water

Energy resources

- Energy needs
- Renewable and non-renewable energy sources
- Use of alternate energy sources
- Impact of energy use on environment

(8 Lectures)

Module 4 : Bio-diversity and its conservation

Value of bio-diversity - consumptive and productive use, social, ethical, aesthetic and option values.
Bio-geographical classification of India – India as a mega diversity habitat
Threats to biodiversity-Hot-spots, habitat loss, poaching of wildlife, loss of species, seeds etc.
Conservation of bio-diversity-In-situ and Ex-situ conservation

(3 Lectures)

Module 5 : Environmental Pollution – Local and Global Issues

Causes, effects and control measures of

- Air pollution
- Indoor air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Solid waste management, composting, vermiculture
- Urban and industrial wastes, recycling and re-use

Nature of thermal pollution and nuclear hazards
Global Warming
Acid Rain
Ozone depletion

(8 Lectures)

Module 6 : Environmental problems is India

Drinking water, Sanitation and public health
Effects of activities on the quality of environment

Urbanisation
Transportation
Industrialization
Green revolution

Water scarcity and Ground Water depletion
Controversies on major darns – resettlement and rehabilitation of people problems and concerns
Rain water harvesting, cloud seeding and water shed management

(5 Lectures)

Module 7 : Economy and Environment

The economy and environment interaction
Economics of development, preservation and conservation
Sustainability : theory and practice
Limits to Growth
Equitable use of resources for sustainable lifestyles
Environmental Impact Assessment

(4 Lectures)

Module 8 : Social Issues and the Environment

Population growth and environment
Environmental education
Environmental movements
Environmental Development

(2 Lectures)

Module 9 : Institutions and Governance

Regulation by Government
Monitoring and Enforcement of environmental regulation
Environmental Acts

Water (Prevention and Control of pollution) act
Air (Prevention and Control of pollution) act
Envt. Protection act
Wild life protection act
Forest Conservation act
Coastal Zone Regulations

Institutions and policies relating to India
Environmental Governance

(5 Lectures)

Module 10 : International Conventions

Stockholm Conference 1972
Earth Summit 1992
World commission for environmental Development (WCED)

(2 Lectures)

Module 11 : Case Studies

Chipko movement
Narmada Bachao Andolan
Silent Valley project
Madhura Refinery and Taj Mahal
Industrialization of Pattancheru
Nuclear reactor at Nagarjuna Sagar
Tehri dam
Ralegaon Siddhi (Anna Hazare)
Kolleru lake – aquaculature
Florosis in Andhra Pradesh

(3 Lectures)

Module 12 : Field work

Visit a local area to document and mapping environmental assets – river / forest / grass land / hill / mountain

Study of local environment – common plants, insects, birds
Study of simple ecosystems – pond, river, hill slopes etc.
Visits to Industries, Water treatment plants, affluent treatment plants.

(5 Lectures)

NAM 224 – ENGINEERING THERMODYNAMICS - II

Periods/week: 5 Ses.: 30 Exam: 70
Examination Theory: 3hrs. Credits: 4

1. I.C. engines: classification, comparison of two stroke and four stroke engines, comparison of S.I. and C.I. engines. Air cycles- Otto, Diesel, Dual, Stirling, Ericson and Atkinson cycles and their analysis. Valve timing and port timing diagrams- Efficiencies- air standard efficiency, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, volumetric efficiency and relative efficiency. Testing and performances of I.C. engines. Basic principles of carburetion and fuel injection.

2. Combustion in I.C. Engines: S.I. engines- Normal combustion and abnormal combustion- Importance of flame speed and effect of engine variables, types of abnormal combustion pre-ignition and knock, Fuel requirements and fuel rating, anti-knock additions- Combustion chamber requirements and Types of combustion chamber- Design principles of combustion chambers. C.I. engines- Stages of combustion- Delay period and its importance- effect of engine variables, diesel knock, suction compression and combustion induced turbulence, open and divided combustion chambers.

3. Reciprocating and Rotary Compressors: Reciprocating compressors, effect of clearance volume in compressors, volumetric efficiency, single stage and multi stage compressors, effect of inter cooling in multi stage compressors. Vane type blower, centrifugal compressor- Adiabatic efficiency- Diffuser- Axial flow compressors- Velocity diagrams, degree of reaction, performance characteristics.

4. Gas Turbines: Simple gas turbine plant- Ideal cycle, closed cycle and open cycle for gas turbines. Efficiency, work ratio and optimum pressure ratio for simple gas turbine cycle. Parameters of performance- Actual cycle, regeneration, Inter-cooling and reheating, closed and semi-closed cycle. Jet propulsion and Rockets.

5. Refrigeration: Bell Colemen cycle, Vapor compression cycle- effect of suction and condensing temperature on cycle performance. Properties of common refrigerants, Vapor absorption system, Electrolux refrigerator.

6. Principles of psychrometry and Air conditioning- Psychrometric terms, psychrometric process, air conditioning systems.

Text Books:

1. Internal Combustion Engine fundamentals by Heywood J B, ISBN0-07-100499-8 Mc. Graw Hill Company.
2. Applied Thermodynamics-II by R. Yadav.
3. A Treatise on Heat Engineering by Vasandhani and Kumar.

References:

1. I.C. Engines by V. Ganesan.
2. Thermal Engineering, by R.K.Rajput.
3. I.C. Engines, by Mathur and Nehata.
4. Gas Turbines, by Cohen and Rogers.
5. Fluid Flow Machines, by M.S. Govinda Rao, Tata McGraw Hill publishing company Ltd.
6. Refrigeration and Air-conditioning, by C.P.Arora and Domokundwar.

NAM 225 -Mechanics of solids-II

Periods/week : 5 Sess: = 30 Exam: 70
Examination theory :3hrs Credits: 4

1. Statically indeterminate Beams :
   Fixed Beams : Fixing moments of a fixed beam of uniform cross section .Effect of sinking of supports ,Slope and deflection.
   Continuous beams : Analysis of continuous beams ,Reaction at the supports, Effect of sinking of supports.B.M. and S.F. diagrams.

2. Coloumns and struts : Introduction ,Examples of instability ,Critereia for stability of equilibrium.Euler's buckling theory –coloumns with pinned ends ,Coloumns with different end restraints,Limitaions of Euler's formulae. Column carrying eccentric loads,Empirical ormulae.
3. Bending of curved bars : Stresses due to bending of curved bars of crcular,rectangular and trapezoidal sections ,curved bars subjected to eccentric loads such as crane hook.

4. Stresses due to rotation : Wheel rim,disc of uniform thickness. Disc of uniform strength.
5. Thick cylinders : Subjected to internal and external pressure and compound cylinders.
6. Theories of failure : Application to design of shafts.
7. Energy methods : Introduction ,Strain energy and complimentary strain energy theorems.Castigliano's theorems-applications to plane trusses.Virtual work principle –applications to plane trusses.

Text Books :

1. Engineering mechanics of solids by E.P.Popov,second edition ,PHI.
2. Mechanics of solids by R.C.Hibbler.
3. Strength of materials by L.B.Shah and Dr R.T.Shah

* NAM 226 – MATERIAL SCIENCE AND METALLURGY

Periods/week : 4 Ses. : 30 Exam : 70
Examination Theory: 3hrs. Credits: 4

(Common with Mechanical Engineering.)

Space lattice and unit cells. Crystal systems. Indices for planes and directions. Structures of common metallic materials. Crystal defects: Point, Line and Surface defects & effects on properties.

Solid solutions. Intermediate phases. Inter metallic compounds. Gibbs rule. Binary phase diagrams. Lever rule. Invariant reactions. Iron-Iron Carbide phase diagram. Heat treatment of steel. Isothermal transformation curves. Annealing, Normalizing, Hardening, Tempering, Austempering and martempering of steels. Surface hardening of steels. Carburizing, Nitriding, Cyaniding, Flame and Induction hardening methods.

Classification of steels: I.S., AISI - SAE classifications. Use and limitations of plain-carbon steels. Alloy steels. Plain carbon and low alloy steels. Tool steels. Cemented carbides. Stainless steels. Maraging steels. Hadfield steel. Cast irons. Grey, White, Malleable and SG irons. Alloy cast-irons. Non-ferrous metals and alloys. Copper and copper-base alloys. Brasses and the bronzes. Copper nickel and Monel alloys. Properties and applications. Aluminium, its uses. Wrought and cast alloys of aluminium.

Plastic deformation: Slip, twining critical resolved shear stress. Ductile and Brittle fracture.. Mechanism of Creep and Fatigue. High temperature alloys. Metals at low temperature. Effect of low temperature on properties: Low temperature metals. Powder Metallurgy. Basic steps in and typical applications of powder metallurgy.

Composite materials. Classification. Matrices and reinforcements. Fabrication methods. Examples and applications.

Text Books:

1. Materials Science and Engineering, by V.Raghavan.
2. Physical Metallurgy, by S.H.Avner.

References:

1. Materials Science and Engineering by L.H.Van Vleck, Fifth Edition, Addison-Wesley (1985).
2. Structure and Properties of Materials by R.M.Rose, L.A.Shepard and J.Wulff, Vol.1-4, John Wiley (1966).
3. Essentials of Materials Science by A.G.Guy, McGraw-Hill (1976).
4. The Science and Engineering of Materials by D.R.Askeland, Second Edition, Chapman and Hall (1990).

* NAM 227 - ELECTRICAL TECHNOLOGY

Periods/week : 5	Ses. : 30	Exam : 70
Examination Theory: 3hrs.	Credits: 4	

(Common with Mechanical Engineering.)

Magnetic Circuits: Definitions of magnetic circuit, Reluctance, Magneto motive force (m.m.f.), Magnetic flux, Simple problems on magnetic circuits, Hysteresis loss. (Chapter-8, Pages 155-175).

Electromagnetic Induction: Faraday's laws of Electromagnetic induction, Induced E.M.F., Dynamically induced E.M.F., Statically induced E.M.F., Self inductance, Mutual inductance. (Chapter-9, Page 176-190).

D.C. Generators: D.C. generator principle, Construction of D.C. generator, E.M.F. equation of D.C. generator, Types of D.C. generators, Armature reaction, Losses in D.C. generator, Efficiency, Characteristics of D.C. generators, Applications of D.C. generator. (Chapter-10, 11, Pages 208-238).

D.C. Motors: D.C. motor principle, Working of D.C. motors, Significance of back E.M.F., Torque equation of D.C. motors, Types of D.C. motors, Characteristics of D.C. motors, Speed control methods of D.C. motors, Applications of D.C. motor. Testing of D.C. machines: Losses and efficiency, Direct load test and Swinburne's test. (Chapter-12,13, Pages 239-267).

A.C. Circuits: Introduction of steady state analysis of A.C. circuits, Single and balanced 3-phase circuits. (Chapter-16, pages 323-348).

Transformers: Transformer principle, EMF equation of transformer, Transformer on load, Equivalent circuit of transformer, Voltage regulation of transformer, Losses in a transformer, Calculation of efficiency and regulation by open circuit and short circuit tests. (Chapter-20, pages 423-455).

Three Phase Induction Motor: Induction motor working principle, Construction of 3-phase induction motor, Principle of operation, Types of 3-phase induction motor, Torque equation of induction motor, Slip-torque characteristics, Starting torque, Torque under running condition, Maximum torque equation, Power stages of induction motor, Efficiency calculation of induction motor by direct loading. (Chapter-21, pages 463-489).

Alternator: Alternator working principle, EMF equation of alternator, Voltage regulation by sync. impedance method. (Chapter-23, pages 505-515).

Synchronous Motor: Synchronous motor principle of operation, Construction, Methods of starting of synchronous motor. (Chapter-24, pages 516-526).

Electrical Measurements: Principles of measurement of current, voltage, power and energy, Types of Ammeters, Voltmeters, Watt-meters, Energy meters, Electrical conductivity meter, Potentiometer, Megger.

Text Book:

1. Elements of Electrical Engineering and Electronics by V.K. Mehta, S. Chand & Co.

Reference:

1. First Course in Electrical Engineering by Kothari.

* NAM 228 – ELECTRICAL TECHNOLOGY LAB

Periods/week : 3 Ses. : 50 Exam : 50
Examination Practical: 3hrs. Credits: 2

(Common with Mechanical Engineering.)

List of Experiments:

1. Study and Calibration of wattmeter and energy meter.
2. Measurement of armature resistance, field resistance and filament resistance.
3. Verification of KCL and KVL.
4. Superposition theorem.
5. Parameters of a choke coil.
6. OC and SC tests on transformer.
7. Load test on D.C. shunt machine.
8. O.C. test on D.C. separately excited machine.
9. Swinburnes test.
10. 3 phase induction motor (No load and rotor block tests) load tests.
11. Alternator regulation by Syn. Impedance method.

NAM 229- ENGINEERING THERMODYNAMICS LABORATORY

Periods/week : 4 Ses. : 50 Exam : 50
Examination Practical: 3hrs. Credits: 2

List of experiments to be conducted:

1. Determination of flash and fire points of oil samples - using Cleveland's apparatus
2. Determination of flash point of oil samples - using Abel's and Pensky-Martin's apparatus
3. Determination of Kinematic viscosity - using Redwood Viscometer – I & II, Saybolt's viscometer
4. Determination of calorific value of solid and liquid fuels using Bomb Calorimeter.
5. Aniline point test,
9. Calibration of pressure gauge - dead weight tester.
10. Volumetric efficiency of reciprocating air compressor.
11. Valve timing diagrams of IC engines(2 & 4 stroke engines).
12. Study of equipment to supplement theory, Boiler models, & I.C. Engine Components.
13. Experiments covering performance and other tests on:Diesel Engines – Single cylinder, and Multi cylinder
14. Experiments covering performance and other tests on:Petrol Engines
15Refrigerating system and ice plant
16.Wind Tunnel