VELS UNIVERSITY

PALLAVARAM - CHENNAI - INDIA

VELS INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)

(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)

B. Tech.
Naval Architecture and Offshore Engineering

Curriculum and Syllabus

(Based on Choice Based Credit System)

Effective from the Academic year

2015-2016

Department of Naval Architecture and Offshore Engineering

School of Ocean Engineering

SYLLABUS

CORE COURSES

Semester 1

15ETN001 Engineering Mathematics–I 3 1 0 3

Course Objective: To develop the students' ability in engineering mathematics such as trigonometry, Hyperbolic functions, differential calculus, Cartesian and polar form, and integral calculus in order to solve problems related to ship and offshore structure design.

Unit I Trigonometry **9**

De Movier's Theorem and its applications - Expansion of Sin nθ, cosnθ, and Sin^n θ, cos^n θ. Hyperbolic functions - Separation into real parts and imaginary Parts - simple problems. Summation of series using C + is method.

Unit II Differential Calculus I **9**

Successive Differentiation of Standard forms -Leibnitz's theorem (Statement only)- simple problems. Length of Sub tangent and Subnormal. Tangent and normal in Cartesian and polar form. Curvature, radius and centre of curvature in Cartesian and polar form - Evolutes and Envelopes.

Unit III Differential Calculus II **9**

Functions of two variables - Partial derivatives - Euler's theorem on homogeneous functions and its generalization - total differentials Jacobian- Taylor's series in the case of two variables - Maxima /Minima of Two variables - Lagrange's method of undetermined multipliers.

Unit IV Integral Calculus I **9**

Basic concept of integration -Integration by trigonometric substitution, Integration by parts, Integration by Bernoulli's rule. Reduction formulae - Properties of definite integrals - beta functions and gamma functions and problems.

Unit V Integral Calculus II **9**

Operations under the sign of integration - multiple integrals - change of order of integration - Transformation of coordinates –Area of solids, Volume of solids and Surface area of solids using multiple integrals.

Total hours: 45

TEXT BOOK

1. Dr. B.S.Grewal, “Higher Engineering Mathematics”, 40th edition, Khanna Publishers, New Delhi, 2007

REFERENCE BOOK

1. H.K.Dass, “Engineering Mathematics”, S. Chand Publishers, New Delhi, 2008

Semester 1

15ETN002 Engineering Physics-I 3 0 0 3

Course Objective: To develop the students' ability in engineering physics such as mechanics and properties of matter, Heat ant Thermodynamics, Sound and waves, Optics and Conducting material in order to gain sound knowledge to solve naval architecture related problems.

Unit I Mechanics and Properties of Matter **9**

Newton's laws of motion-principle of conservation of linear momentum-angular momentum-relation between force and torque-moment of Inertia and radius of gyration-physical significance of M.O.I.-elasticity-modulus of elasticity- Poisson's ratio-shear-shear angle-couple per unit twist for a uniform cylinder and hollow cylinder-bending moment restoring couple –uniform bending- "I "form of girders-basic ideas of surface tension and viscosity.

Unit II Heat and Thermodynamics **9**

Kinetic theory of gases-postulates-expression for the pressure of a gas-root mean square velocity-perfect gas equation-kinetic energy of a molecule-mean free path behavior of real gas-Andrew's isothermal-Vanderwaals equation-triple point –basic idea of statistical physics-quantum statistics-first and second law of thermodynamics-Carnot's engine efficiency-reversibility-entropy.

Unit III Sound and Waves **9**

Classification of sound-progressive wave –stationery waves-forced vibration and resonance-characteristic of musical sound-loudness-Weber- fecher law-Decibel-absorption coefficient-reverberation time-Sabine's formula (growth and decay)- factors affecting acoustics of building(reverberation time, loudness, focusing, eco, echelon effect, resonance and noise) and their remedies.

Unit IV Optics **9**

Luminous flux-intensity of illumination- Lamber's cosine law-intensity of light required for a class, operation theatre and a hall-velocity of light-Michelson method-introduction to wave theory-interference-Michelson interferometer-type of fringes determination of wavelength-thickness of thin transparent sheet-introduction to diffraction-resolving power-Rayleigh's criteria-expression for intensity of plane, circularly and elliptically polarized light-photo elasticity-birefringence-stress-optic law effect of stressed model in a polariscope-isoclinic and isochromatic fringes-photo elastic bench.

Unit V Conducting material **9**

Conduction in metals-mobility and conductivity-classical free electron theory of metals-electrical conductivity-thermal conductivity-Weidmann Franz law-Lorentz number-draw backs of classical theory-band theory of solid-classification of solids into metals, semiconductors and insulators on the basis of band theory-Fermi distribution function function-density of energy states-carrier concentration in metals-energy distribution of electrons-calculation of density of holes and electrons.

Total hours: 45

TEXT BOOKS

1. A Marikani , “Engineering Physics”, PHI Learning Private Limited, 2nd edition, 2013.
2. G Vijayakumari, “Engineering Physics”, Vikas Publishing House PVT LTD, 7th edition, 2013.

REFERENCE BOOKS

1. Dr. Mani p, “Engineering Physics”, Dhanam Publications, Chennai-42.
2. Pilli S.O. “Solid State Physics”, New Age International Publication, New Delhi, fifth Edition, 2003.
3. Palanisamy P.K., “Physics for enginers”, Scitech Publications (India) pvt Ltd., Chennai, second Edition, 2005.
4. ArumugamM.,”Engineering physics”, Anuradha Agencies, Kumbakonam, Second Edition, 2005.
5. Avadhanulu M.N. and Kshirsagar P.G., “ A Text Book of Engineering Physics”.S.Chand& Company Ltd, 7 th Enlarged Revised Ed., 2005.

Semester 1

15ETN003 Engineering Chemistry 3 0 0 3

Course Objective: To develop the students' ability in engineering chemistry in areas such as water and its treatment, fuels and combustion, lubricants, electrochemistry in order to gain sound knowledge to solve naval architecture related problems.

Unit I Water and Its Treatment **10**

Sources of water, hard and soft water, types of hardness, determination of hardness by EDTA method, softening of water- external conditioning - lime soda process, zeolite process, ion exchange process, internal conditioning. Alkalinity – type of alkalinity, determination of alkalinity. Boiler feed water requirements. Boiler problems-scales and sludge, priming and foaming, caustic embrittlement,corrosion..

PHASE RULE
Terminology, simple examples of one component (water), condensed phase rule, binary alloy system

Unit II Fuels and Combustion **10**

Classification and properties of fuel, calorific value determination using bomb calorimeter. Solid fuels- Analysis - proximate and ultimate analysis, hydrogenation and carbonization of coal.Liquid fuels- Outline of petroleum processing, characterization of various constituents vizPetrol diesel with regard to their application in IC engines, Petrol and diesel knocking, refining and reforming, octane and cetane number. Gaseous fuels – Coal gas, producer gas, biogas, water gas analysis using orsat apparatus.

Unit III Lubricants **6**

Mechanism of lubrication, greases or semi-solid lubricants, solid lubricants, synthetic lubricants, lubricating emulsions, properties of greases, cutting fluids, selection of lubricants, classification and properties of lubricating oils (viscosity, flash and fire point and cloud and pour points).

Unit IV Electrochemistry **8**

Conductance of electrolytes and its measurements, application of conductance, Measurements- conductometric titrations, theory of strong electrolytes, kohlraushs law, ostwalds dilution law, common ion effect, theory of indicators, pH of a buffer solution. Electrodes, standard and single electrode potential, electrochemical series, Nernst Equations, cell terminology, cell reactions galvanic cells, fuel cells, lead acid battery. Introduction to CORROSION SCIENCE Chemical and electrochemical corrosion, types of corrosion, general methods of prevention and control of corrosion, sacrificial anode method, paints, varnishes and enamels, metallic coatings, hot dipping, galvanizing, electroplating.

Unit V Production of Engineering Materials **11**

Production of steel- Bessemer converter process, open hearth process, Chemical addition to steels, heat treatment of steel. Production of non ferrous alloys - aluminium and its alloys, brass bronze, special

reference to ship building (ship propellers etc), Inorganic engineering materials - cement manufacture, composition, setting and hardening, Nomenclature of polymers, types of polymerization, mechanism of addition, Polymerization, thermosetting and thermoplastics, engineering plastics - nylon plastics, ethylene plastics, Bakelite, fabrication of plastics, production of GRP material.

Total hours: 45

TEXT BOOKS

1. Dr. V. Balasubramaniam, Dr. Sreedevi, Dr. G. Ramachandran, Engineering Chemsitry, CARS Publishers, West mambalam, Chennai-33, 2010.
2. Jain & Jain, “Engineering chemistry”, Dhanpat Rai Publishing Company, New Delhi, 13th edition, 2001.

REFERENCE BOOKS

1. Balasubramaniam M.R., KrishnamoorthyS.& Murugesan,” Enggineering chemistry” Allied publishers
2. M.M.Uppal , “A textbook of engineering chemistry” Khanna publishers.
3. Goyal R. N. & Goyal H., Textbook Of Engineering Chemistry, 2nd Edition, Ane Books private Ltd

Semester 1

15ETN004 Basic Electrical and Electronics Engineering 3 0 0 3

Course Objective: To understand basics of electrical engineering and the fundamentals to develop and understand ship board electrical systems which will be useful for the student to design the electrical systems.

UNIT I Introduction 9

Introduction – Basic laws of circuit theory - Electrical Elements and their classification, Kirchhoff's Current Law and equations & Kirchhoff's Voltage Law and equations. Determination of Loop current and Determination of node voltage method.

UNIT II D.C. Circuits: 9

Steady state analysis with independent sources and dependent sources –Series circuits and parallel circuits, Star-delta conversion, Superposition theorem, Thevenin's theorem, Maximum Power Transfer Theorem.

UNIT III A.C. Circuits 9

A.C. Single-phase Circuits Common signals and their waveform, RMS and Average value, form factor & peak factor of sinusoidal waveform Impedance of series and parallel circuits. Phasor diagram Power, power factor, power triangle, coupled circuits, Resonance and Q-factor.

UNIT IV Three phase circuits 9

Three phase Circuits; star - delta, line and phase relation, power relations, analysis of balanced and unbalanced -Three phase circuits. Superosition. Thevenin's and Norton's Maximum Power Transfer Theorem for A.C circuits.

UNIT V Magnetic Circuits 9

Magnetic Circuits Introduction, Series-parallel magnetic circuits, Analysis of Linear and non-linear magnetic circuits, Energy storage, A.C excitation Eddy currents and hysteresis losses. Introduction to Ship Board Electrical Machinery & systems.

Total hours: 45

TEXT BOOKS

1. V.K. Mehta & Rohit Mehta, Basic Electrical engineering, S Chand
2. I. J. Nagrath, Basic Electrical Engineering, 2nd edition, Tata Mc Graw Hill .

REFERENCE BOOKS

1. Arthur Eugene Fitzgerald, David E. Higginbotham, Arvin Grabel, Basic Electrical Engineering, 1981, McGraw-Hill
2. Mittle & Mittal , Basic Electrical Engineeing, 2nd Edition, Tata Mc Graw Hill Publishing Company

Semester 1

15ETN005 Basics of Computers & Utilities 3 0 0 3

Course Objective: To understand fundamental concepts of computer which will help students to develop their ability in ship and offshore structure design. The Ship design software which the student will be using later in the design offices are all based on the computer basics.

Unit I Introduction to Computer **9**

Block Diagram of Digital Computers and its functions, Classification of computers (Micro, Mini, Mainframe and Super computer)

Unit II Input Output devices **9**

External Storage devices. The software (OS, Utility programs, Application Programs, Languages etc)

Unit III Fundamentals of Computer Concept **9**

Bit – Byte, Decimal Number system, Octal Number system, Hexa decimal Number System Conversions, Program Language generations, Data - Record - File- Database, Master file - Transaction File - Work File - Backup File, Types of file organizations (Sequential, Index & Direct)

Unit IV Operating System **9**

Introduction - Types of OS, Functions of OS - Processor Management, Memory Management - Device Management, Information Management – Compiler, Assembler - Interpreter - Loader and Linker

Unit V Internet and web Technologies **9**

Internet: Net working Concepts an Over View - Evolution of Internet Working of Internet (DNS, IP Address, Word Address, Dial Up Connection, Dedicated Line Connection, ISDN, E-Mail and Browsers) Applications of Computer.

Total hours: 45

TEXT BOOK

1. D. S. Yadav, Foundations of information technology, 2006,New Age International (P) Limited

REFERENCE BOOKS

1. D.P. Nagpal, Computer fundamental concepts systems and applications, Wheeler publishing
2. E Balagurusami, Programming in basic ,Tata mc-Graw hill

Semester 1

15ETN006 Computer Practical Lab 0 0 2 1

Course Objective: To understand and develop fundamental working knowledge in computer utilities to enable students to improve his ability in correspondence with various shipyards, offshore design companies and yards and equipment manufacturers and spare part suppliers.

List of Experiments:

1. Knowledge of working in Windows
2. MS- WORD (a) Using templates
3. MS Word (b) Font adjustment,
4. MS Word (c) spell checker using Menu commands
5. MS-EXCEL (a) Using data entry,
6. MS Excel (b) adjustments, graphs.
7. MS Excel (c) formulae. MS-POWERPOINT (a) Presentations
8. MS Power point (b) charts, graphs
9. MS Power Point (c) import and Export of data.
10. MS- ACCESS (a) Using data entry, Reports,
11. MS-Access (b) Small menu entries Internet Applications like Browsing,
12. MS-Access (c) Email communication and Using Search Engines etc.

Total hours: 40

TEXT BOOKS

1. Chanchal Mittal, Pragati Prakashan, Foundations of information technology.
2. D.P.Nagpal, Fundamentals Concepts, Systems & Applications, Wheeler Publishing

REFERENCE BOOKS

1. Chanchal Mittal- PragatiPrakashan, Foundations of Information Technology
2. E.Balagurusami, Computer Programming in BASIC, Tata McGraw-Hill
3. Peter Dyson, Pat Coleman & Lan Gilbert, The ABC's of Internet, BPB

Semester 1

15ETN007 Engineering Graphics Lab 0 1 2 2

Course Objective: To understand and develop fundamentals of engineering drawing which will be useful to understand ships drawings and calculations. The ship design calculation and drawing (SDCD) is based on this fundamental subject, Engineering graphics.

UNIT I Explanation and sketching **8**

Explanation and sketching of the following aspects: Dimensioning conventions of shafts, arcs, angles, **I**holes, tapers, welded joints threads and pipes Conventional representation of metals and materials. Sectioning Conventions, removed sections and revolved sections, parts not usually sectioned, Conventions of gears

UNITII Limits and tolerances **8**

Limits, Fits and Tolerances Limits and tolerances, Surface Finish, Type of fits - Description, Hole basis System and Shaft basis system, calculations involving minimum and maximum clearances for given combination of tolerance grades- Simple problems, Geometric tolerances

UNIT III Sketching **8**

Sketching of the following: Screw threads, screwed fastenings, Rivets and riveted joints. Machinery Component drawing: Drawing of complete machine components in assembly (orthographic to isometric and isometric to orthographic) with details like couplings, Glands, Return and non-return valves, cocks & plugs, cylinder, Boiler mountings - Full bore safety valve, Blow down cock, Gauge glass, Main stop valve.

UNIT IV Marine component drawing **8**

Marine Component Drawing: Assembly Drawing of simple marine components in orthographic projection from Isometric view e.g. Bilge Strainer boxes, Marine diesel piston, Cylinder relief valves, control valve .

UNIT V Projection drawings **8**

Basic concepts of orthographic projections of points, straight lines, planes and solids, section of solids, development and intersection of surfaces, concepts of isometric views, nuts, bolts and screw fastenersAssembly drawing from the given details or details from the given assembly drawing of the following machine elements, simple machines, Steam engine parts etc. Foot step bearing, Rigid flanged coupling, Simple eccentric of steam engine. Piston ~ Ring - rod of steam engine, Stuffing box of Stem tube.

Total hours: 40

TEXT BOOKS

1. N.D.Bhatt, “Engineering drawing (plane and solid geometry)”, Charotar publishing house private limited, 53rd edition, 2015.
2. K. Venugopal and V. Prabhu Raja, “A textbook of engineering graphics”, New age international (P) limited publishers, reprint, 2015.

REFERENCE BOOKS

1. Gopalakrishna K.R., "Machine Drawing", 17th Edition, Sub has Stores Books Corner, Bangalore, 2003.
2. Gill P.S., "A text book on Machine Drawing", S.K. Kataria & sons, Mumbai, 2000.
3. Reed's Engineering Drawing for Marine Engineers (Reed's Marine Engineering Series) (11) (2nd Ed.) Author(s): BECK H.G.
4. Mac Gibbon's "Pictorial Drawing Book for Marine Engineers-James", 8th Edition,
5. G.Holburn & John J. Seaton, James Munro &Company Limited Engineering and Nautical Publishers, Mumbai, 1978.

Semester 1

15ETN008 Workshop Practice-I 0 0 3 2

Course Objective: To enhance practical skills of the students in fitting, gas welding, pipe fitting etc which will help the students to understand the shipyard practices during the construction and outfitting of the ships and the offshore structure.

Fitting Workshop
Hands on experience in preparation of V - Joint, Dove tail Joint, T-Joint and Square Joint.

GAS WELDING
Hands on experience in preparation of Butt Joint, Lap Joint, T-Joint and Fillet Joint.

Pipe Fitting Shop
Hands on experience in preparation of Pipe fitting, Pipe Joints, Overhauling valves and pressure testing of valves.

Carpentry
Hands on experience in preparation of Square Joint, T-Joint and Dove tail Joint.

REFERENCE BOOKS

1. Workshop manuals

Total hours: 40

Semester 2

15ETN009 Engineering Mathematics-II 3 0 0 3

Course Objective: To develop the students' ability in understanding engineering mathematics in areas such as differential equation, partial differential equation, algebra of matrices, differentiation and integration of vectors.

UNIT I Ordinary Differential Equation 9

First order Linear Differential equation-Bernoulli's equation-Exact diff. Equation-Equations of I order higher degree-Solvable for p, x, y- Clairaut's Equation-Application to engineering problems .Higher order equations with constant coefficient-Method of variation parameters

UNIT II Partial Differential Equations 9

Formation of Partial Differential Equation-Solution of PDE by direct integration-Solution of Lagrange's equation Pp + Qq = R-Nonlinear equations of first order-Four Types- f (p, q) = 0, f(z, p, q) = 0, f(x, p) = F (y,q) andz = xp + yq + f (p, q).

UNIT III Algebra of Matrices 9

Rank of a matrix-Gauss Jordan method to find the inverse-consistency and inconsistency of system of linear equations-solution of system of linear equations-characteristic equation -Eigen values and Eigen vectors-Cayley Hamilton Theorem

UNIT IV Differentiation of vectors 9

Vector Differentiation-velocity and acceleration-Vector operator Del, gradient Divergence and curl-Physical interpretation of divergence of F and Curl F – Del Applied twice to point functions and Del applied to product of point functions.

UNIT V Integration of Vectors 9

Line integrals- Work-Surface integrals - Flux-Green's Theorem n, the plane - Stoke's Theorem- Volume integral-Gauss Divergence Theorem-Simple Problems

Total hours: 45

TEXT BOOK

1. Dr. B.S.Grewal, "Higher Engineering Mathematics", 40th edition, Khanna Publishers, New Delhi, 2007

REFERENCE BOOK

1. H.K.Dass, "Engineering Mathematics", S. Chand Publishers, New Delhi, 2008

Semester 2

15ETN010 Engineering Physics-II 3 0 0 3

Course Objective: To develop the students' ability in understanding engineering physics in areas such as ultrasonics, laser and fibre optics, relativity and quantum mechanics, Semi conducting and superconducting materials, Dielectrics, New materials and NDT in order to gain sound knowledge to solve naval architecture related problems.

UNIT I Ultrasonic and Crystal physics **9**

Ultrasonic production - magnetostriction and piezoelectric methods - determination of velocity of ultrasonic waves-SONAR-lattice planes -Miller indices -'d'spacing in cubic lattice - calculation of number of atoms per unit cell-atomic radius-coordination number-packing fact for SC, BCC, FCC and HCP structures.

UNIT II Laser and Fiber Optics **9**

Einstein coefficient (A &B) - ND-YAG laser, semiconductor laser - uses of lasers-holography-construction and reconstruction of a hologram – principle and propagation of light in optical fiber -numerical aperture and acceptance angle-types of optical fiber-applications-fiber optics sensors (displacement sensor and pressure sensor).

UNIT III Relativity and Quantum mechanics **9**

Einstein's special theory of relativity - Lorentz transformation – length contraction - time dilation – mass - energy relationship-black body radiation - Plank's theory – deduction of Wien's displacement law and Rayleigh – Jean's law from plank's theory - Compton effect - theory and experimental verification - Schrodinger's wave equation – time independent-physical significance of wave function - particle in a one dimensional box.

UNIT IV Semi conducting and superconducting materials **9**

Extrinsic semiconductor - expression for carrier concentration in n - type and p - type semiconductors-variation of Fermi level with temperature and impurity concentration - Hall effect-determination of Hall coefficient – super conducting phenomena – properties of superconductors - Meissner effect and isotope effect - type I and type II superconductors high temperature superconductors-uses of superconductors.

UNIT V Dielectrics, New materials and NDT **9**

Electrical susceptibility - dielectric constant - electronic, ionic, orientation and space charge polarizations-frequency and temperature dependence of polarization-internal field- Claussius - Mositti relation-uses of dielectric materials-metallic glasses - nano materials-shape memory alloys-bio materials-non destructive testing- liquid penetration method-ultrasonic flaw method-ultrasonic flaw detector-X-ray radiography-displacement method-X-ray fluoroscopy-merits and demerits of each method.

Total hours: 45

TEXT BOOKS

1. Dr. Mani P,"Engineering Physics", Dhanam Publications, Chennai-42.
2. PalanisamyP.K., "Physics for Engineers", Scitech Publications (India) Pvt Ltd.,Chennai, Second Edition, 2005.

REFERENCE BOOKS

1. S.Chand& Company Ltd, 7 th Enlarged Revised Ed., 2005.
2. Pillai S.O. "Solid State Physics", New Age International Publication, New Delhi,Fifth Edition, 2003.
3. Arumugam M., "Engineering Physics", Anuradha Agencies, kumbakonam, Second Edition, 2005.

Semester 2

15ETN011 Engineering Mechanics 3 0 0 3

Course Objective: To develop the students' ability in understanding engineering mechanics in areas such as concurrent forces, properties of areas, forces in planes etc., so that the same can be applied to the engineering problems in the ship building industry.

Unit I Concurrent forces in a plane **9**

Concurrent forces in a plane - Review of vectors, statics, types of forces, Moments, Parallel forces in a plane.

Unit II Properties of areas **9**

Properties of areas- moment of inertia of plane figure about an axis, principal axes of three dimensional bodies, calculation of mass moment of inertia of plates, cylinders and spheres.

Unit III General cases of forces in a plane **9**

General cases of forces in a plane - Equilibrium of forces in a plane, plane trusses, method of joint and sections, method of substitution funicular polygon, Maxwell diagrams, flexible suspension cables. Cantilever and simply supported beams with concentrated and distributed and moment loads, S.F and B.M Diagrams, Stress and Strain.

Unit IV Force system in space **9**

Force system in space, principle of virtual work, efficiency of simple machines stable and unstable Equilibrium, Interfacial friction - static, kinetic and rolling friction, Application to inclined planes, wedges, Screw jacks and belts.

Unit V Kinematics and Kinetics of particles **9**

Kinematics and Kinetics of particles - Rectilinear motion of particles relative motion, D' Alembert's principle, inertia couple, constrained motion, non centroidal motion, translation and rotation of rigid bodies, virtual work energy arid work. Curvilinear translation, rotation of rigid body, plane motion of a rigid body, impulse and momentum, conversion and momentum, momentum and momentum equation, rotational motion.

Total hours: 45

TEXT BOOKS

1. S. Rajasekara, “Engineering Mechanics-Statics and dynamics”,
2. Dr. K.L. Kumar, “Engineering Mechanics”, Tata Mcgraw Hill

REFERENCE BOOKS

1. Timoshenko & Young, “ Engineering Mechanics”, CBS Publishers and distributors private limited, new Delhi, 2004.
2. R. S. Khurmi , Engineering Mechanics, S. Chand and company Ltd. 2008
3. Beer & Johnson, Engineering Mechanics, Tata Mc-Graw Hill, NewDelhi, 2009

Semester 2

15ETN012 Material Science 3 0 0 3

Course Objective: To develop the students' ability in understanding engineering materials and its metallurgical properties, phase transformations and phase diagram, heat treatment process, various types of steel used for ships and offshore structure construction which form the basis for construction of ships and offshore structures.

UNIT I Introduction **9**

Introduction - Role of materials in Technology - Historical development -Economy of material usage - Classification of materials. Structure of Solid. Atomic structure - crystal structure-atomic packing in crystal-miller indices Imperfections in crystals-Types of bonds-Bonding forces and energies - influence of bond type on Engineering properties-thermodynamics and kinetics in materials behaviour - diffusion - structure of metal, alloy, polymer and ceramic strengthening mechanism in metal-metallography.

UNIT II Phase transformation and Phase diagram **9**

Solidification - nucleation - crystallization - single crystal and poly crystalline materials - Polymorphism - Thermodynamic reasoning of phase diagram-simple phase diagram phase rule - lever rule - methods used to determine a phase diagram - Isomorphous system - Eutectic - Eutectoid, preutectic phase diagram - Iron - Carbon system-Martensite formation TTT diagram Hardenability Tertiary system.

UNIT III Heat Treatment **9**

Annealing-process annealing - Spheroidizing - Normalising - Quenching and Tempering process - Austempering - Martempering - Case hardening – Alteration of materials properties by casting, working, joining, sintering – Precipitation – Age hardening - recovery and recrystallisation.

UNIT IV Mechanical properties of Materials and Testing **9**

Elastic, plastic, viscoelastic deformation- Tensile test for metals, polymers, ceramic-Strain aging-fracture - brittle fracture-Griffith's criterion of brittle fracture-fracture toughness-Ductile - brittle transition in fracture - Hardness - fatigue - creep - testing of mechanical properties - Failure analysis and prevention - wear of metal - NDT. Structural Materials

UNIT V Types of steel **9**

Classification of steel-different types of steel-Aluminum& Titanium alloys used in shipbuilding-Propeller materials-Selection of materials-Specification classification society rules-National and International standards for different class of steels.

Total hours: 45

TEXT BOOK

1. V. Raghavan, Material Science and Engineering, Prentice-Hall of India (P)Ltd New Delhi.

REFERENCE BOOKS

1. Donald S Clark-Physical Metallurgy for Enginees, East West Press (P) Ltd, New Delhi.
2. A.G. Guy-Introduction to Materials science, McGraw Hill Ltd International Student Edition.
3. Hanson - The Engineer's Guide to steel, Addision - Wesley Pub.Company Inc.
4. Stephen. C. Dexter - Handbook of oceanographic engineering materials

Semester 2

15ETN013 C Programming & Language 3 0 0 3

Course Objective: To understand fundamental concepts of computer programming which will help students to develop their ability in programming languages which the student will be using later in the ship and offshore design offices.

UNIT I Basic structure and execution of C Programmes 9

Constants, Variables, Data Types, Various type of Declarations, Different type Operations and expressions, Evaluation and Expressions, Operator precedence and Associability, Mathematical functions.

UNIT II Managing Input and Output Operations and arrays 9

Decision Making, Branching decisions Making and looping, Declaration and Initializations, Two-dimensional arrays, Initialization arrays, Dynamic Arrays, String Variables.

UNIT III Reading and Writing strings 9

Arithmetic operations on characters, Putting strings together, Comparison of two strings. String – handling functions, Table and other features of strings.

UNIT IV Need and elements for user defined functions 9

Functions, Return value of function, Functions call and declaration, Arguments and corresponding return values, Multiple Values, Nesting functions, Recursion, Passing arrays and strings to functions, The Scope, Visibility and life time of variables

UNIT V Structure Variables 9

Declaring structure, Variable and accessing structure members, Initialization of structure, Comparing structure variables. Arrays of structure, Structure within structures, Structure and functions, Unions, Size of structures, Bit fields.

Total hours: 45

TEXT BOOKS

1. E. Balagurusamy ,C- Programming ANSI , Tata McGraw-Hill Education, 2008
2. Chanchal Mittal, “Foundations of Information Technology”, Pragathi Prakashan Publishers, 9th edition, 2013.

REFERENCE BOOKS

1. A.K. Kanthane-programming with ANSI and TURBO C, Pearson education, New Delhi, 2004
2. Y. Kannetkar- Let us C 4th Edition BPB Publication, New Delhi, 2002.

Semester 2

15ETN014 C Programming Practical 0 0 2 1

Course Objective: To understand fundamental concepts of computer programming which will help students to develop their ability in programming languages which the student will be using later in the ship and offshore design offices.

List of Experiments

1. Program to show swap of two numbers without using third variable.

2. Program to find the Largest and Smallest of the given three numbers

3. Program to find the roots of the Quadratic Equation

4. Program to print the Fibonacci series upto 100.

5. Program to reverse a given number.

6. Program to find area and perimeter of circle and square using switch case

7. Program to display series and find sum of 1+3+5+……..+n.

8. Program to find whether a string is palindrome or not and to count no of Vowels and consonants in a string

9. Program to show Sum of 10 elements of array & show the average and to find the maximum and minimum number in an array

10. Program to find factorial of a number using recursion function and to perform Mathematical operation using function

11. Program to find sum of diagonal elements in a Matrix and to find sum and multiplication of two matrixes.

12. Program to swap the numbers using pointer and to find mark list using structure

Total hours: 40

Semester 2

15ETN015 Physics Lab 0 0 2 1

Course Objective: To develop the students' ability in understanding principles of refractive index, harmonic motion, resistance, frequency, wavelength of sodium light, voltage, monochromatic light, etc., which will be useful to the student in their profession.

List of Experiments

1 Error analysis in measurements

2 To determine the wave length of prominent spectral lines of mercury light by a plane transmission Grating

3 To determine the resistance per unit length of a Carey fosters bridge wire

4 To determine the frequency of AC mains with the help of sonometer.

5 To determine the wavelength of sodium light by Newton ring method

6 measurements of voltage and frequency of a given signal using Lissajous figures

7 To determine wavelength of monochromatic light by fresnalbi prism

8 Ray tracing of optical components and to prove the laws of geometrical optics

9 Verification of Brewster's law and to find the refractive index of the material

10 Measurements of magnetic field along the axis of a circular coil and to verify Biot-Savart law

11 Specific rotation of sugar solution by using polarimeter

12 Measurements of spring constant using simple harmonic motion

13 Measurements of Numerical Aperture of a plastic Fiber

14 Verification Paschen's curve in a gas discharge tube

Total hours: 40

Semester 2

15ETN016 Chemistry Lab 0 0 2 1

Course Objective: This is designed to expose the students to classical methods of analysis as well as instrumentation methods. Some experiments deal with the conventional volumetric gravimetric techniques, semi- micro techniques, ion-selective electrodes, conductometric methods, spectroscopic methods, and thermal analytical methods.

List of Experiments

1. Introduction to various analytical techniques (conventional techniques like volumetric, gravimetric, and electrochemical, separation and spectrophotometric techniques), statistical methods employed in analytical techniques, general awareness regarding laboratory upkeep and safety.

2. Qualitative semi-micro analysis of cations and anions.

3. Qualitative semi-micro analysis of mixture of cations and anions by group separation methods.

4. Chromatographic techniques: (a) Identification of unknown mixture by spot test analysis (b) Quantitative determination of Limonene using gas chromatography (c) acetylation of ferrocence and analysis using TLC (d) Pesticide analysis using HPLC.

5. Spectroscopic techniques: (a) Quantitative analysis of total iron / copper / chromium / Ag / Hg present in given sample of water using AAS (b) Verification of Beer-Lambert's law using UV-vis spectrophotometer.

6. Electrochemical techniques (a) Determination of dissociation constant and titration using conductance of electrolytic solutions (b) Acid hydrolysis of ethyl acetate.

7. Thermo chemical measurements: (a) DSC of given sample (b) determination of calorific value using Junker/ Bomb calorimeter.

8. Water pollution monitoring and control: (a) DO determination (b) BOD (c) COD (d) Free chlorine (e) pH and alkalinity (f) total Hardness (g) MPN count (h) Optimizing the dose of added coagulant by Jar test (i) Analysis of alum and determination of water soluble alum compounds as alumina (Al_2O_3)

9. Air pollution monitoring and control: (a) Flue gas analysis using Orsat apparatus (b) Analysis of SO_2 (c) analysis of NOx, CO and CO_2.

10. Use of advanced techniques for chemical waste minimization:

    (a) Application of computational technique in chemistry

    (b) Application of combinational chemistry.

11. Fuel and Lubricants: (a) determination of open and close flash points (b) determination of Viscosity using Redwood-I viscometer (c) Proximate analysis of given solid fuel (d) Ultimate analysis

Total hours: 40

Semester 2

15ETN017 Electrical & Electronics Engineering Lab 0 0 2 1

Course Objective: To develop the students' ability in understanding the usage of ammeter, voltmeter, current and voltage distribution, three phase induction motors, Power and power factor of single phase circuits, relation between line and phase quantities in 3 phase star and delta connection etc.,

List of Experiments

Experiment No. 1
Measurement of' Low and High resistances by Voltmeter and Ammeter method

Experiment No.2
To obtain the currents and voltage distribution in A.C. 'P-L-C' series circuits and Draw the vector diagrams.

Experiment No.3
To obtain the currents and voltages distribution in A.C. 'R-L-C' parallel circuits and draw the vector diagrams.

Experiment No. 4
Power and power factor of single phase circuits: To measure the power and power factor of a single-phase lead by 3 voltmeter method& 3 ammeter method.

Experiment No.5
To obtain the relation between line and phase quantities in 3 phase star and Delta connection.

Experiment No.6
To measure the power input to 3-phase induction motor using two watt meters.

Total hours: 40

Semester 2

15ETN018 Workshop Practice-II 0 0 3 2

Course Objective: To develop the students skill in usage of lathe machinery, arc welding set and fitting workshop activities which will be useful to the students while working in shipyards and offshore construction yards in dealing with the in various activities of manufacture.

Lathe Workshop

Hands on experience in preparation of turning, Facing, Taper turning, Thread cutting and External thread cutting.

Arc Welding

Hands on experience in preparation of Butt Joint, Lap Joint, T - Joint, outside corner Joint and Fillet Joint.

Fitting Workshop

Hands on experience in preparation of various types of joints

Total hours: 40

Semester 3

15ETN019 Engineering Mathematics-III 3 0 0 3

Course Objective: To develop students ability to solve problems using fourier series, laplace transform, partial differential equations, numeric methods, numerical differentiation and integration, Trapezoidal and Simpsons rule and their engineering applications in ship design calculations.

UNIT I Fourier series **9**

Definition of Fourier's series-Fourier coefficients-Expansion of functions in Fourier series-Even and odd functions-Half range Fourier series for any interval (-L, L).Harmonic analysis-Estimation of Fourier coefficients given values of a function in its domain

UNIT II Laplace Transform **9**

Definition-Laplace Transform of standard functions-Inverse Laplace Transform-Solution of ordinary linear differential equations by Laplace Transform method - Engineering applications

UNIT III Applications of Partial Differential Equations **9**

Method of separation of variables - Wave equations - One dimensional heat flow equation - two dimensional heat flow equation - Problems.

UNIT IV Numerical Methods **9**

Finite Differences- Differences of a polynomial - Factorial notation - Difference Operators - Newton's interpolation formulae (backward and forward-No proof) - Lagrange's formula for unequal intervals

UNIT V Numerical Differentiation and Integration **9**

Numerical Differentiation using Newton's formulae - Numerical Integration Trapezoidal Rule, Simpson's 1/3 rd and 3/8 th rule - Engineering applications - Formation and solution of Linear Differential equations.

Total hours: 45

TEXT BOOK

1. Dr. B.S.Grewal, “Higher Engineering Mathematics”, 40th edition, Khanna Publishers, New Delhi, 2007

REFERENCE BOOK

1. H.K.Dass, “Engineering Mathematics”, S. Chand Publishers, New Delhi, 2008

Semester 3

15ETN020 Fundamentals of Naval Architecture 3 0 0 3

Course Objective: To develop student's ability to understand fundamentals of ships architecture, type of ships, principles of floatation, lines plan, concept of floating bodies, including materials used in ship building, trapezoidal and Simpsons rule, ship design and shipyard layout, etc.,

UNIT I Introduction **9**

Historical introduction to the development of the merchant ship in the context of developing world trade. Introduction to basic design feature and ship terminology. Classification of ship by types and functions.

UNIT II Type of Ships **9**

General arrangement related to the ship type including cargo and passenger ship, fishing vessels, warships, workboats and vessels for pleasure.

UNIT III Concept of Floating bodies **9**

Basic hydrostatic concept of a floating body. Role and impact on design and operation of Classification Societies, IMO and Regulating Authorities. Materials used in shipbuilding.

UNIT IV Introduction to ship design **9**

Introduction to ship design. Lines plan – fairing process- table of offsets, Interaction rules – trapezoidal rule; Simpson's rule (1-4-1, 1-3-3-1 and 5, 8,-1 rule) 6 ordinate rule; Tchebycheff's rule, areas, volumes and moments Bonjean calculations and curves, Hydrostatic calculations and curves

UNIT V Buoyancy and weight **9**

Buoyancy and weight of the ship, Water tight subdivision of ship, Shipyard layout

Total hours: 45

TEXT BOOKS

1. Rawson & Tupper, "Basic Ship Theory", Butterworth-Heinemann, 2013.
2. Lewis, E.U.; "Principles of Naval Architecture", (2nd Rev.), SNAME, New Jersey, U.S.A.
3. R. Bhattacharya, "Dynamics of Marine Vehicles", John Wiley & Sons, 1988.

REFERENCE BOOKS

1. Tupper, E.C.: Introduction to Naval Architecture, Butterworth- Heinemann, UK, 1998.
2. Kemp and Young ,Sketches and notes
3. DJ Eyres, "Ship construction", Butterworth-Heinemann Publishers, 7th edition, 2012.
4. Professional journals and periodicals such as "B.E Naval Architects", "Motor ship", "Significant ship".

Semester 3

15ETN021 Theory of Ships 3 0 0 3

Course Objective: To develop student's ability to understand fundamentals of ship architecture, stability of ships, metacentric height, transverse stability, longitudinal stability, damage stability, effect of superstructure on stability, stability functions, dynamical stability, etc.

UNIT I Introduction **12**

Introduction- Potential energy and equilibrium; Stability of ships - stable and unstable conditions (including submerged vessels); Stability terms;

UNIT II Metacentric height **12**

Equi -volume inclinations - shift of C.O.B.due to inclinations, C.O.B. curve in lateral plane, metacentre, pro-metacentre and metacentric radius, metacentric height, metacentric curve, surface of flotation, curve of flotation, righting moment and lever; Moments due to wind, shift of cargo, passengers, turning and non-symmetrical accumulation of ice; Effect of superstructure on stability.

UNIT III Transverse Stability **12**

Transverse stability:- Form and weight stability - stability functions

a) Initial stability – GM, GZ at small angles of inclinations, wall sided ships; Stability due to addition, removal and transference (horizontal, lateral and vertical) of weight, suspended weight and free surface of liquids; Stability while docking and grounding; Inclining experiment.

b) Large angle stability - Diagram of statical stability (GZ - curve), Characteristics of GZ - curve, static equilibrium criteria; Methods for calculating the GZ - curve (Krylov, Prohaska, etc.); Cross curves of stability; Dynamical stability - diagram of dynamical stability, dynamical stability criteria.

UNIT IV Longitudinal Stability **12**

Longitudinal stability - trim, longitudinal metacentre, longitudinal centre of flotation, moment to change trim, trimming moment; trim calculations - addition, removal and transference of weight, change of density of water.

UNIT V Damage Stability **12**

Damage stability - deterministic and probabilistic approach. Stability in Waves ,recommendations of classification societies and governmental authorities - Intact and damage stability rules, Flooding calculation, floodable length, Launching curves, launching calculations

Total hours: 60

TEXT BOOKS

1. Rawson & Tupper, “Basic Ship Theory”, Butterworth-Heinemann, UK, 2001.
2. Lewis, E.U.; “Principles of Naval Architecture”, (2nd Rev.), SNAME, New Jersey, U.S.A.

REFERENCE BOOKS

1. Tupper, E.C.: Introduction to Naval Architecture, Butterworth- Heinemann, UK, 1998.
2. Kemp and Young, “Ship Construction Sketches and notes”, Butterworth-Heinemann Publishers, 2nd edition, 1997.
3. DJ Eyres, “Ship construction”, Butterworth-Heinemann Publishers, 7th edition, 2012.
4. Professional journals and periodicals such as “B.E Naval Architects”, “Motor ship”, “Significant ship”.

Semester 3

15ETN022 Fluid Mechanics 3 0 0 3

Course Objective: To develop student's ability to understand fundamentals of fluid mechanics, fluid motion, equation of motion, Newton's law of fluid friction, laminar and turbulent flow, various types of pump, friction coefficient, continuity equation etc.,

UNIT I Properties of Fluids **9**

Properties of fluids – ideal fluid – actual fluid – fluid pressure, **s**tates of fluids – Euler's equilibrium conditions – constant velocity rotation around a fixed axis – forces on walls of container – surface tension – atmospheric equilibrium

UNIT II Fluid motion **9**

Fluid in motion – one dimensional flow – continuity equation – Euler's equation – Bernoulli's equation – energy equation for unsteady flow, Generalized Bernoulli's equation – Newton's law of fluid friction – laminar flow – Poiseuille's flow – turbulent flow – Reynold's number – Prandtl's mixing length – friction coefficient

UNIT III Types of Pumps and Turbines **9**

Pumps & Turbines – reciprocating pump – air vessels – roto dynamic pumps – velocity diagram- Impulse turbine – Pelton wheel – reaction turbine – Francis turbine – Kaplan turbine,

UNIT IV Two and Three dimensional flow **9**

General theory of two and three dimensional flow – continuity equation – circulation – Stoke's integral theorem – sources – sinks – dipole – flow with circulation – potential flow – hydro dynamical lift – Kutta – Joukowski theorem

UNIT V Viscous Flow **9**

Pattaks motion, biot, Savart;s law, cortex sheets, viscous flow, boundary theory, criterion for separation, turbulent boundary layer, airofoils, lift, drag, circulation, pressure distribution, cavitation.

Total hours: 45

TEXT BOOKS

1. K.L Kumar: Engineering Fluid Mechanics, Eurasia Publishing house, New Delhi
2. Dr. Jagdishlal: Hydraulic machines, Metropolitan book Co, Delhi.
3. Vallentine: Applied hydrodynamics, Butterworths, London.

REFERENCE BOOKS

1. Walther Kaufmanns: Fluid Mechanics, Tata McGraw – Hill publishing company Ltd.
2. Daugherty &Franzini – Fluid Mechanics with Engg. Application, International Student's edition McGraw Hill.
3. Massey: Fluid Mechanics, ELRS
4. Schlichting: Boundary layer theory
5. A.K. Mohanty: Fluid Mechanics

Semester 3

15ETN023 Applied Thermodynamics 3 0 0 3

Course Objective: To develop student's ability to understand fundamentals of thermodynamics, laws of thermodynamics, gas power cycles, one dimensional study flow, second law of thermodynamics, energy equation, heat pumps, entropy change etc.,

UNIT I Introduction

Introduction: Basic definitions (System, Control volume, work, best process etc) Zeroth law of thermodynamics; Ideal gas-equation of state.

UNIT II First law of thermodynamics

Closed system undergoing a cycle; closed system undergoing a change of state; Internal energy of a system, Expansion work; Process using ideal gas – constant Pressure, constant volume, isothermal, adiabatic and polytrophic process - work done and heat added in different process. First law applied to one – dimensional steady flow process, flow energy, steady flow energy equation (ID).

UNIT III Second law of Thermodynamics

Different statements; Reversible and irreversible process; corollaries of second law - Absolute temperature scale; Carnot cycle - Carnot engine, refrigerator and heat pump.Clauscius inequality and definition of entropy change of entropy of an ideal gas. Pure substance
Equilibrium diagram - T -s, p- V, p- V, h-s, etc

UNIT IV Gas Power cycles and I.C. Engines

Gas power cycles Carnot cycle, Brayton cycle, Erricson cycle, Sterling cycle etc.; Air standard cycles Otto-Diesel, Dual and Joule cycle; Evaluation of thermal efficiency and mean effective pressure Internal Combustion engine, Classification of I.C. engines - Principle of operation of spark ignition and Compression Ignition engines both two stroke and four stroke. Stages of combustion in S.I. and C.I. engines Knocking and detonation-factors controlling knock and detonation, methods of preventing Knocking and detonation.

UNIT V Steady state Heat Transfer

Modes of heat transfer and their mechanisms. Conduction - Fourier's law of heat conduction – Heat conduction through composite walls and cylinders, Steady state heat convection. Free and forced convection - Definition of Unset, Reynolds, Praudit and Grashoffs number and their significance. Estimation of convection heat transfer coefficient using empirical formula for free convection over horizontal and vertical plates and cylinders, forced convection through pipes. Heat – exchangers Different types - Log mean temperature difference for parallel flow and counter flow heat exchangers. Radiative heat transfer Emissive power-Stephan Boltzman law- Definition of black body, grey body, Emmissivity, Absorptivity etc., Kirchoffs law of radiation. Estimation of heat transfer by radiation for simple cases like infinite parallel planes infinite concentric cylinders, and concentric spheres

Total hours: 45

TEXT BOOKS

1. Nag. P.K.; Engineering Thermodynamics, Tata McGraw-Hill Publishing co.Ltd., 1998
2. Ballaney, P.L.; Thermal Engineering, vol I, Khanna Publishers, New - Delhi.

REFERENCE BOOKS

1. James P. Todd & Herbert B. Ellis; Applied Heat Transfer, Herper& Row Publishers, New York.
2. Holman, J.P.; Thermodynamics, McGraw-Hill-international Student Edition.

Semester 3

15ETN024 Strength of Materials 3 0 0 3

Course Objective: To develop student's ability to understand fundamentals of various types of loads and stresses on structure, bending of beams, principal stresses, triaxial state of stresses, strain energy, strain deformation, shear stresses, boundary conditions, etc.,

UNIT I Introduction **9**

Introduction-type of loads and stresses-definition of uni-axial, bi-axial and tri-axial state of stresses-displacements and deformations. Tension, Compression and Shear-uniaxial stresses-Hooke's law of material behaviors deformation, in stress direction -lateral deformation, Poisson's ratio-differential equation of displacement, boundary conditions-strain energy for uniaxial loading.

UNIT II Type of stresses **9**

Biaxial tension and compression-stresses in thin-walled pressure vessels (cylindricaland spherical)-analysis of biaxial stresses-Mohr's circle for biaxial stresses, principal stresses for triaxial state of stress.

UNIT III Strain energy **9**

Torsion of circular shafts-shear stresses, shear deformation, differential equation of the rotational displacement, strain energy.

UNIT IV Bending of beams **9**

Symmetrical Bending of beams- shear force and bending moment diagrams assumption of the technical theory of bending, strain and stress distribution, linearised moment - curvature - relation, differential equation of deflection (2nd & 4th order).Boundary conditions, strain energy, oblique bending.

UNIT V Shear stresses and combined loads **9**

Transverse shear-shear stress-simplified deformations due to shear stresses- differential equation of the additional deflection caused by transverse shear-strain energy. Combined loads-failures (fracture, yielding, loss of stability)-hypothesis of failure Stability of beams - types of equilibrium, Euler's theory of buckling, approx. Determination of Critical 1oad.

Total hours: 45

TEXT BOOKS

1. RS Khurmi, Strength of materials, S Chand & Company Ltd, New Delhi-110055.
2. Dr. H. J. Shah, S. B. Junnarkar, Mechanics of structures Vol.I, Charotar Publishing house, India.
3. Ramamrutham, Strenth of Materials, Dhanpat RaiPublishing Company (P) Ltd, New Delhi,2009

REFERENCE BOOKS

1. Timoshenko; Strength of Materials, East-West Publications 2004.
2. Popov, Engineering Mechanics of Solids, Prentice-Hall Publications.
3. Krishna Raju & Gururaja; Advanced Mechanics of Solids and Structures, Narosa Publications.

Semester 3

15ETN025 Design of Machine Elements 3 0 0 2

Course Objective: To develop student's ability to understand fundamentals of stresses in machine parts design processes, joints, couplings, bearings, gears, torsion and bending of shafts, couplings, bearings, hydrodynamic slide bearing etc.,

UNIT I Machine design fundamentals 9

Fundamentals of machine design:-definitions, design process, design principles, design criteria; Stresses in machine parts-working stress, safe stress, factor of safety, endurance limits, fatigue factors.

UNIT II Classification of springs 9

Elastic springs-classification and uses of springs-allowable stresses and deflections design for fluctuating loads.

UNIT III Type of joints 9

Joints- Principles of force transmission; detachable joints (pins, keys, splines, and bolted joints), Non-detachable joints; welded, soldered and glued joints, riveted joints, strength of welded and riveted joints.

UNIT IV Design of Shafts 9

Drive elements - shafts - torsion and bending of shafts, design of shafts for strength and deflection, effect of key ways, crank shafts. Shaft couplings: - Rigid coupling (flange and compression couplings)-couplings with kinematics flexibility-slip couplings fluid couplings.

UNIT IV Bearings 9

Bearings: - Slide bearings-introduction to lubrication, hydrodynamic bearings, bearing materials, design of slide bearings. Roller bearings- types, static & dynamic load, capacity, bearing life and selection of Bearings.

UNIT V Type of Gears 9

Gears: - Types (spur and parallel helical gears) and function of gears, strength of gear teeth, stresses and stress concentration in gears-design of gears. Design of a cast part, design and calculation of welded subassembly, design of a valve spring, design and calculation of dynamically loaded screw joint, design and calculation of a shaft-boss joint (e.g. interference fit), design and drawing of a hydrodynamic slide bearing, design of gears on parallel exes.

Total hours: 45

TEXT BOOKS

1. J.E. Shifley: Mechanical Engineering Design, McGraw-Hill.
2. R.K. Jain, Machine Design, Khanna Publications, New Delhi.

REFERENCE BOOK

1. Kalpakjian, Manufacturing Engineering & Technology, 3rdWesley ISBN #0-201.53846-.

Semester 3

15ETN026 Ship Design Calculation Drawing & Drafting – I (SDCADD- I) 0 0 2 1

Course Objective: To develop student's ability to understand ship design calculations and drawings by practically carrying out manually or using AUTOCAD. The subject involves ship-lines plan, offset table, hydrostatic calculations, hydrostatic curves, shell expansion drawing, bonjean curves, floodable length calculation, tank plan, etc.

Manual drawing and AutoCAD Practicals:

1. Ship-lines plan drawing (Manual &Acaddrg) and offset table
2. Autocad drawing commands & exercises
3. Draw Lines plan of ships(Manual &Acaddrg) and offset table
4. Hydrostatics calculation (Excel sheet)
5. Hydrostatic curves (Manual &Acaddrg)
6. Shell expansion drawing (Manual &Acaddrg)
7. Bonjean curves.
8. Calculation of hydrostatics,(Trim & Stability)
9. Stability curves (on graph sheet) and stability booklet
10. Floodable length calculation & curve(on graph sheet)
11. Tank plan, Capacity plan
12. Watertight integrity plan(internal)

Total hours: 40

Semester 3

15ETN027 Engineering Mechanics Lab 0 0 2 1

Course Objective: To develop student's ability to understand experimentally bending moments, funicular polygon, belt friction, pulley block for lifting various loads, Worm and worm wheel, screw and screw jacks, helical springs, etc.

List of Experiments

1. Bending Moments - To determine experimentally the bending moment in (a) A cantilever and (b) A simply supported beam and to compare experimental values with the theoretical values.
2. Funicular Polygon - To find magnitude and position of resultant force experimentally and to check the same by constructing the Funicular Polygon Graphically.
3. Belt Friction - To determine the value of u between the Belt and the pulley.
4. Fly Wheel- To determine the moment of Inertia of a fly wheel by falling weigh method and to also determine the friction moment in the bearings.
5. Friction - To compare coefficient of friction between two given pairs of surfaces by Sliding on an inclined plane.
6. Screw and Screw Jack - to compare effort required for lifting various loads, effort lost in friction and efficiency for (a) Screw jack and (b) Winch crab.
7. Pulley Block - To compare effort required for lifting various loads, effort lost in friction and efficiency for 4-pulleyed and 5 pulley systems.
8. Worm and worm wheel- To determine effort required for lifting various loads effort lost in Friction and efficiency.
9. To find the force of friction and moment of inertial of a rolling wheel by application of General equations of plane motion.
10. Helical spring - To study the compression/Extension of a helical spring and to find its Stiffness and modulus of rigidity at various loads.

Total hours: 40

Semester 3

15ETN028 Strength of Materials Lab 0 0 2 1

Course Objective: To develop student's ability to understand experimentally Standard tension test on UTM, Shear strength on UTM, deflection characteristic of open and closed springs, hardness measurement by Brinell, Rockwell methods, Charpy and Izod impact tests, etc.

List of Experiments

1. Standard tension test on UTM (Al or MS Rod)
2. Shear strength of MS rod on UTM
3. Deflection characteristic of open and closed springs.
4. Determination of 'G' of wires using torsion pendulum.
5. Hardness measurement - Brinell, Rockwell
6. Charpy and Izod impact tests
7. Maxwell's theorem and estimation of Young's modulus
8. Natural frequency and damping of cantilever beams.
9. Stress concentration for a hole on a plate under tension using photo-elasticity.

Total hours: 40

Semester 3

15ETN029 Fluid Mechanics Lab 0 0 2 1

Course Objective: To develop student's ability to understand experimentally friction factor for the turbulent flow, metacentric height of the floating vessel, characteristic curves for reciprocating Pump, calibration of triangular notch section, comparative study and performance behaviour of different types of mouth pieces.

List of Experiments

1. To determine the friction factor for the turbulent flow into the commercial pipes of various sizes (FRICTION IN PIPES).

2. To determine the Metacentric height of a floating vessel (METACENTRICHEIGHT).

3. To determine the coefficient of contraction, discharge and velocity for flowthrough an orifice (circular) (ORIFICE).

4. To Calibrate a given notch on triangular in cross-section (TRIANGULARNOTCH).

5. To draw the characteristic curves of the Reciprocating Pump.(RECIPROCATING PUMP).

6. To draw the characteristic Curves for a Pelton wheel at a constant speed(PELTRON TURBINE).

7. Comparative study and performance behaviour of different types of Mouth pieces
   (a) Cylindrical
   (b) Converging
   (c) Diverging

Total hours: 40

Semester 4

15ETN030 Engineering Mathematics – IV 3 0 0 3

Course Objective: To develop student's ability to understand mathematical analysis and random variable, statistical quality control, design of experiments, testing of hypothesis, correlation and regression, covariance of two dimensional random variables, central limit theorem, control charts for measurements, etc.

UNIT I Random Variable 9

Axioms of Probability-Conditional Probability-Total Probability-Bayes Theorem-Random Variable-Probability Mass Function-Probability Density Functions-Properties- Binomial, Poisson and Normal distribution

UNIT II Two Dimensional Random Variable 9

Joint distributions – Marginal and conditional distributions – Covariance –Correlation and regression – Transformation of random variable – central limit theorem

UNIT III Testing of Hypothesis 9

Sampling distributions –Testing hypothesis for mean, variance, proportions and difference using normal ,t-square, chi-square and F- distributions –Tests for independence of attributes and goodness of fit.

UNIT IV Design of Experiments 9

Analysis of variance – One way classification – Completely randomized design – Two way classifications-Randomized Block design – Latin square

UNIT V Statistical Quality Control 9

Control charts for measurements (X and R charts) –
Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

Total hours: 45

TEXT BOOKS

1. Papoulis A and Unnikrishnapillai S., "Probability, Random variable and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.

REFERENCE BOOKS

1. Milton.J.S. and Arnold.J.C, " Introduction to probability and Statistics', Tata McGraw Hill, 4th Edition, 2007
2. T. Veerarajan, "Probability statistics andRandom process
3. Dr. B.S. Grewal, "Higer Engineering Mathematics", 40th edition, Khanna Publishers, New Delhi, 2007

Semester 4

15ETN031 Resistance of Ships 3 0 0 3

Course Objective: To develop student's ability to understand various components of ships resistance and determination of ships resistance by various methods, Froude's and Reynold's law, model-ship correlation, comparison of resistance prediction with results of full scale trials, shallow water resistance calculation, model –ship correlation, etc.

UNIT I Mathematical and Physical models 9

Components of ship resistance, Dimensional analysis.Laws of comparison - geometrical, dynamical and kinematic Similarity, Newton's, Froude's and Reynold's law, model-ship correlation.

UNIT II Ship Resistance 9

Frictional resistance, Viscous resistance - turbulent plate friction and plate resistance, viscous pressure Resistance, separation and resistance due to separation, influence of curvature of the Ship's hull, form factor. hull roughness and its influence on frictional resistance. Frictional resistance coefficients

UNIT III Wave Resistance 9

Wave Making resistance, pressure resistance, ship wave system, interference effects, Theoretical calculation of wave making resistance, wave breaking resistance, Bulbous bows and their effects.

UNIT IV Model Testing and extrapolation 9

Model testing - tank testing facilities, testing, and prediction of resistance from model tests, extrapolation, Froude's concept, laminar influence and tank wall effect, comparison of resistance prediction with results of full scale trials.

UNIT V Determination of resistance 9

Determination of resistance from series test results - residuary resistance, effect of hull form on resistance, Taylor series, Series 60, B S R A series, SSPA series, etc.; statistical analysis of resistance data, Guldhammer-Harvald's and Danckwardt's method. Resistance of planning crafts, multi-hull vessels, hovercrafts, hydrofoils, barges and convoy of barges. Air and wind resistance, Resistance of appendages, Added resistance in waves; Resistance in restricted waterways - resistance in shallow water, resistance in canals. Blockage and blockage correction, hull forms, dependence of ship condition, resistance calculation using Guldhammer and Harvald series, shallow water resistance calculation, model –ship correlation.

Total hours: 45

TEXT BOOK

1. Rawson & Tupper, "Basic Ship Theory", Butterworth-Heinemann, UK, 2001.
2. Lewis, E.U.; "Principles of Naval Architecture", (2nd Rev.), SNAME, New Jersey, U.S.A.
3. Harvald S.A., "Resistance and propulsion of Ships", John Wiley & Sons.

REFERENCE BOOKS

1. Tupper, E.C.: Introduction to Naval Architecture, Butterworth- Heinemann, UK, 1998.
2. Kemp and Young, “Ship Construction Sketches and notes”, Butterworth-Heinemann Publishers, 2nd edition, 1997.
3. DJ Eyres, “Ship construction”, Butterworth-Heinemann Publishers, 7th edition, 2012.
4. Professional journals and periodicals such as “B.E Naval Architects”, “Motor ship”, “Significant ship”.

Semester 4

15ETN032 Fundamentals of Offshore Structures 3 0 0 3

Course Objective: To develop student's ability to understand various loads to which the offshore structure is subjected to, types of offshore structures and various equipments on the offshore structure loading mechanisms, mooring hardware components etc.

UNIT I Introduction **9**

Offshore Structures and Deepwater challenges, Functions of Offshore Structures, Offshore Structure Configurations, Bottom Supported Fixed Structures, Complaint Structures, Floating Structures. Material for Construction-Structural Steel, Topside Materials, Advanced Composite materials , Corrosion Control , Material Reliability and Monitoring and Fracture Control

UNIT II Load and Responses **9**

Introduction, Gravity Load, Hydrostatic Loads, Resistance Loads, Current loads on Structures, Current Drag and Lift Force, Steady and Dynamic Wind Loads on Structures, Wave Loads on Structures, Varying Wind Load, Impulse loads and Introduction to design

UNIT III Mooring System **9**

Introduction, Loading Mechanisms, Mooring Hardware components, Industry Standards and Classification Rules

UNIT IV Topside Facilities and Layout **9**

Introduction, General layout Considerations, Areas and Equipment, Deck Impact Loads, Deck Placement and Configuration, Float over Deck Installation, Helipad, Platform Crane

UNIT V Offshore Installation **9**

Introduction, Fixed Platform Substructures, Floating Structures, Foundations, Subsea Templates, Platform Installation Methods.

Total hours: 45

TEXT BOOKS

1. Dawson, T.H., Offshore Structural Engineering, Prentice Hall, 1983
2. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.
3. Subrata K Ckakrabarti, "Handbook of Offshore Engineering", Vol 1, Elsevier Publishers, 1st edition, 2005.
4. Subrata K Ckakrabarti., "Handbook of Offshore Engineering", Vol 2, Elsevier Publishers, 1st edition, 2005.

REFERENCE BOOKS

1. API RP 2A., Planning Designing and Constructing Fixed Offshore Platforms, API
2. McClelland, B & Reifel, M.D., Planning & Design of fixed Offshore Platforms, VanNostrand, 1986
3. Graff, W.J., Introduction to Offshore Structures, Gulf Publ. Co. 1981.
4. Reddy, D.V & Arockiasamy, M., Offshore Structure Vol.1 & 2, Kreiger Publ. Co 1991
5. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.

Semester 4

15ETN033 Theory of Structures 3 0 0 3

Course Objective: To develop student's ability to understand structural calculation theories, analysis of stiffened plates, Pure bending plates, flexibility and stiffness matrices, ultimate strength concepts, design of Tubular members, design for dynamic loads, vibration of beams and shafts etc.

UNIT I Continuous beams and strain energy method 9

Continuous beams - Chaperon's three-moment equation, Moment distribution method, Torsion of non-circular sections, shear center of simple cross sections. Strain energy method-principle of virtual work, flexibility method, stiffness method, strain energy and complementary energy, Castiglione's theorems. Introduction of theory of plasticity.

UNIT II Matrix methods 9

The Matrix displacement approach, Introduction, Stiffness matrix of a bar, element subjected to Axial Force, Co-ordinate transformations, Global stiffness matrix, application to Pin-jointed frames, stiffness matrix of a beam element, application to continuous beams.

UNIT III Theory of thin plates 9

Introduction to theory of thin plates, Pure bending of plates, Small deflection analysis of laterally loaded plates, Boundary conditions, Naview solution, Lavy's` solution. Analysis of stiffened plates - orthotropic plate model and other methods. Design of plates for large deflections and permanent set - design of lifting structures such as cranes.

UNIT IV Design of tubular members 9

Design of tubular members for pure and combined stress resultants - brief introduction to optimal member design. Design principles of tubular joints - punching shear and ultimate strength concepts fracture mechanics and fatigue.

UNIT V Design for dynamic loads 9

Design for dynamic loads Vibrations of continuous systems - vibration of strings and rods - vibration of beams - vibration of shafts.

Total hours: 45

TEXT BOOKS

1. Timoshenko & Young; Theory of structures, McGraw Hill Publications.
2. Ramamirutham, "Strength of materials", Dhanpat Rai publishing company (p) limited, new delhi, 17th edition, 2008.
3. Krishna Raju & Gururaja; Advanced Mechanics of solids and structures, Narosa Publications.

REFERENCE BOOKS

1. Reddy, C.S; Basic Structural Analysis, Tata-McGraw Hill Publications.Timoshenko& Young; Theory of plates, McGraw Hill Publications.
2. RD Blevins; Flow induced Vibrations, Van Nostrand Reinhold, 1990.
3. BC Gerwick, Jr. Construction of marine and offshore structures, CRC Press, 2000.
4. N Barltrop, Floating Structures, A Guide for Design and Analysis, OPL , 1998

Semester 4

15ETN034 Strength of Ships 3 0 0 3

Course Objective: To develop student's ability to understand various loads on ship structure, and weight and buoyancy distribution, shear force and bending moment calculations, determination of torsional moments, shear force, bending moments and deflection curves, etc.

UNIT I Loads and Moments on ship structure 9

Loads and moments acting on ship structures - still water loads, physical loads, weight and buoyancy distribution. Determination Longitudinal and vertical bending and shear, load curve, S.F curve, B.M curve, deflection curve. Thermal Loads

UNIT II Loads and moments due to oblique regular waves 9

Loads and moments due to oblique regular waves - vertical bending and shear – wave B.M determination (static wave), Determination of horizontal bending and shear load curve, S.F curve, B.M curve, deflection curve. Determination of torsional moments.

UNIT III Loads in real seaway 9

Loads in a real seaway - wave loads (strip theory etc), irregular seaway, sea spectrum, transfer function, wave BM, torsional moments. Probabilistic approach - short & long term distribution of loads, probability of survival Slamming loads - shipping of green seas Load calculation by classification society rules

UNIT IV Analysis of ship structure 9

Analysis of ship structure - longitudinal strength calculation, .total BM (Mg + Mw + Msetc.,), application of beam theory, hull girder section modulus. Strength of superstructure and deck houses, Longitudinal Strength during launching and docking Local strength assessment - secondary bending, tertiary bending, beam bending (plate bending) ,Ring frame, grillages etc. Thin plates in ship structures - loads, boundary conditions, bending, stiffened plates, submarine hull membrane and bending theory of cylindrical shells.

UNIT V Longitudinal strength and torsion of hull 9

Torsion of hull- shear centre, restrained torsion, finite element methods, Plastic theory application, Ultimate longitudinal strength using classical and FEM. Sources of vibration, definitions, measures to control vibration, Natural frequency determination, stodla iteration. Cargo handling system – Analysis of mast, derrick system, shipboard cranes, hatch Covers etc. Longitudinal strength calculation, Transverse strength calculation

Total hours: 45

TEXT BOOKS

1. Lewis, E.U. Principles of Naval Architecture (2nd Rev) Vol**III**1989 SNAME, New York.
2. Rawson & Tupper, Basic Ship Theory, Butterworth-Heinemann publishers

REFERENCE BOOKS

1. Owen Hughes, Ship structural Design, Prentice Hall
2. Muckle. W: Strength of ships, SNAME Publications

Semester 4

15ETN035 Marine Electrical Technology 3 0 0 3

Course Objective: To develop student's ability to understand electrical motors, starters, switch boards, electrical installations and safety devices, ac generator active and reactive load sharing, generator synchronizing procedure, understand principle of 3 phase alternating voltage generation on board the ship.

UNIT I AC Motors and Starters 9

Understand the Principle of operation of a direct on line starter (DOL) starter, Star delta starter, autotransformer starter, Understand the need and means for motor protection. AC Motors**,** Understand the construction and characteristics of a squirrel cage induction motor Understand the principle of operation of a single phase motor.

UNIT II AC Generator 9

Understand the construction and principle of operation of a three phase ac generator, ac regulation on ac generator, ac generator active and reactive load sharing, generator synchronizing procedure (SIMULATOR).

UNIT III Switch Board 9

Understand the function of the main switchboard, need and methods ac system protection. Neutral System Understand the types of neutral systems and earth fault. Emergency Supplies-The operation and maintenance of commonly used batteries on board ship. The operation of the emergency generator. Insulation Resistance-Understand insulation resistance measurement.

UNIT IV DC Generator 9

Understand the construction and principle of operation of a dc generator. Dc Motor-Understand the construction and operation of dc motor. Ship Lightning-Understand different types of lightings installed onboard ships. 3 Phase Ac System-Understand principle of 3 phase alternating voltage generation.

UNIT V Electrical Installations and Safety 9

Understand hazards of live electrical systems and safe electrical practice. Fuse protection, general maintenance. Instrumentation-Temperature, Pressure, Torque, Rpm measuring devices – methods working Principles.

Total hours: 45

TEXT BOOK

1. Elstan A. Fernandez, Marine Electrical Technology, SPD Publishers, 4th Edition, 2008.

REFERENCE BOOK

1. Dennis t. Hall, "Practical Marine Electrical Engineering", Witherby Publishers, 2nd edition, 1999.

Semester 4

15ETN036 Marine Engineering–I 3 0 0 2

Course Objective: To develop student's ability to understand ships machinery, lubrication systems, engine dynamics, relationship of engine to the propeller, steam turbines, lubrications, cooling systems, etc. so that it is useful to the student during ship design and construction.

UNIT I Machinery selection for ships 9

Ships and machinery - design and selection considerations; Marine diesel engines general engine principles, Low speed and medium speed diesel engines, Constructional features. Fuels, fuel oil system-Scavenging and turbo charging. Starting and reversing systems, controls and safety devices, governing; Lubrication, Lubricants and luboil systems, cooling systems-torque and power measurement, fuel consumption's characteristics, engine lead tests and general characteristics-Heat balance, waste heat recovery system.

UNIT II Engine dynamics 9

Engine dynamics, torsional vibration of engine and shafting, axial shaft vibration, critical speeds engine rating, rating corrections, trial tests etc. Relationship of engine to the propeller classification society rules on engine construction. Engine room arrangement and engine-mounting study of different types of marine engines available in the world market.

UNIT III Boilers and Pumps 9

Marine boilers types, fire tube and water tube boilers, boiler arrangements-steam to steam boilers, double evaporation boilers, exhaust gas heat exchangers, auxiliary steam plant systems, exhaust gas boilers, composite boilers. Boiler mounting, combustion, feed system, feed water treatment, Feed pumps, condensers, air rejecters, deaerators, boiler operation, coal fired boilers.

UNIT IV Marine turbines and propulsion system 9

Marine Steam turbines - Types of turbines, compounding - reheat turbines, turbine construction, rotors, blades, casing, Gland sealing, diaphragms, nozzles, bearings, etc. Lubrication systems, expansion arrangements, control, gearing operating procedure. Marine gas turbines - fundamentals of G.T., Structure of gas turbines, gearing, operational features, controls, gearing, combined cycles. Nuclear propulsion - physical principles of the operation of nuclear reactors – use of nuclear propulsion on seagoing vessels. Automation of ship propulsion plants. Maintenance requirements and reliability of propulsion plants.

UNIT V Air conditioning and Refrigeration 9

Air Conditioning and Refrigeration. Definition and purpose - Psychrometry - psychrometric properties of air- Psychrometric chart – Adiabatic saturation. Psychrometric process Sensible heating and cooling, Humidification and dehumidification, cooling and humidification, Cooling and dehumidification-heating and humidification, Heating and dehumidification, adiabatic mixing of air streams-cooling and heating load calculation Summer and winter air conditioning - Estimation of the state of supply air to the air conditioned space- Quantity of air supply etc. for simple winter air conditioning systems.

Total hours: 45

TEXT BOOKS

1. Harrington; Marine Engineering, SNAME Publications.
2. Taylor, D.A.; Introduction to Marine Engineering.

REFERENCE BOOKS

1. Pounder, C.C; Marine Diesel Engines, Newnen-Butterworths, London.
2. Reed's Marine Engineering for Naval Architect.

Semester 4

15ETN037 Ship Design Calculation Drawing & Drafting – II (SDCADD-II) 0 0 2 1

Course Objective: To develop student's ability to understand practically design calculations and hull drawings, Inclining experiment, Ship strength calculations, midship section drawing, stem and stern forms drawings, wetted surface area estimation, lightship weight estimation, etc.

List of Experiments

1. Inclining experiment report (inclining test procedure)
2. Ship strength in general, Primary, secondary and tertiary stresses.
3. Midship section drawing (manual and Acaddrg)
4. Midship section calculation (MI, Z)
5. Scantling strength calculation
6. Stem and sternforms drawings
7. Types of rudderdrawings(Acaddrg)
8. Arrangement of watertight, non-water tight penetration (Acaddrg)
9. Types of Brackets and ship structural details (Acaddrg)
10. Lightship weight estimation (MS Office Excel sheet)
11. Wetted surface area estimation (MS Office Excel sheet)
12. Painting surface area estimation (MS Office Excel sheet)
13. Arrangement of Cargo Holds, (Acaddrg)
14. Arrangement of Engine Room, (Acaddrg)
15. Arrangement of Tanks, Void spaces, Cofferdams (Acaddrg)
16. Arrangement of accommodation area / living spaces, out fittings (Acaddrg)
17. Types and arrangement of access openings (Acaddrg)
18. Door plan- Types of doors(Acaddrg)

Total hours: 45

Semester 4

15ETN038 Software Lab – Aveva Marine- (Tribon) 0 0 2 1

Course Objective: To develop student's ability to understand and practically work on AVEVA Marine ship design software and develop skills in surface development, compartmentation, design of basic lines, performing fundamental calculations in hydrostatics and hydrodynamics, etc.

AVEVA MARINE (SP 3) AVEVA INITIAL DESIGN GEOMETRY:

Introduction - Creating of New Project - Creating of New Database,

Surface – Introduction-Basic Tool Bars Primitives- Creating and Manipulating 2D Primitives –Blending-Outputs-Offset Table,

Compartment- Introduction Basics of Compartment-New Compartment construction-Releasing Naval Architecture & Production Data-Manual Stitch-Reflect & Cover Container Arrangements,

Line (Design)- Introduction-Basics- Creating Design and Defining-Basic Curves-Creating Control Curves-Creating A Surface – Outputting the surface – Curve Fairing – Modifying the surface directly.

AVEVA INITIAL DESIGN HYDROSTATIC & HYDRODYNAMICS:

Hydrostatic- Introduction Basics- Performing Fundamental Calculations- Running More Complicated Calculations.

Hydrodynamics- Introduction Basics – Powering Calculations- Maneuvering Calculations- Sea keeping Calculations- Dynamic Positioning Calculations.

AVEVA HULL DRAFTING & STRUCTURAL DESIGN:

Hull Drafting- Introduction- Getting Started- Viewing the Ship Model- Basic Geometry- Dimensioning.

Hull Structural Design- Introduction- Initialization, Curved Hull Modeling- Reference Surface Design (RSO) - Displaying Compartments- Functional Structures- Curved Surfaces- Design Utitilities- Block Division.

AVEVA HULL STRUTURAL DESIGN:

Planar Hull Modeling - Introduction- Planal Hull Modeling Concept- Getting Started- Seams- Plates-Excess- Weld Tap Pieces- Panel Specific Curves & Topological points-Stiffners- Flanges- Natches-Cutouts Holes & Doubling Plate-Brackets- Position Number.

Interactive Curver Hull – Introduction- Curved Hull Modeling Concept- Getting Started- Hull Curves-Storable Points- Seams & Butts- Shell Plates- Shell Profiles- Curved Points. PRODUCTION

Information – Introduction- Part List- Material List- Profile Sketching &Manof List- Profile Nesting – Profile Cutting

Total hours: 40

Semester 4

15ETN039 Marine Engineering Lab 0 0 2 1

Course Objective: To develop student's ability to understand practically identification of construction details of main engine, generator, compressors, air bottles, pumps, fire fighting systems, etc. installation details, starting and stopping checks, operation, compressed air system on board the ship, etc.

Main Engine Identification /Construction Details of Various Parts of Main Engine –Cylinders, Cylinder Heads, Pistons, Turbo Charger, Governors, Base Plate, Foundation and Fitment, Foundation Bolts, Chalk Fasts/Steel Chalks, Crank Shafts, Fly wheels, L O Sump, L O Pump, S W Pump, F W pump ,S W Pump, F W Pump, S V Mounts, Injectors etc

Starting and Stopping Checks of Main Engine, Parameters to be observed during the operation of Main engine

Start Main engine after Starting Checks, Run Main Engine for 15 Mins, Observe all parameters, and readings of

(a) L O Pressure
(b) S W Temperature
(c) F W Temperature
(d) Exhaust Temperature
(e) Engine Room
(f) L O temperature

Starting Air System Identify Various Components, Air bottles, Tracing of air system valves, Valves, Main engine Starting Air valve, Various components of air bottles, Securing arrangements of air bottles

Study/identify lifting arrangement of Main Engine

Identification of Construction Details ship generator, Installation details of Prime mover, and alternator, M SB parts, Power distribution system, Starting and stopping checks of generator

Run the generator and take it in load. Note down various parameters. Stop generator after observing stopping checks of generator

Identification of construction details of starting air compressor .Tracing the air system line from air compressor to air bottle. Note down the material of system pipes and valve details

Start the compressor after observing pre – start checks

Charge the starting air bottles and record the time taken to reach the engine starting air pressure

Stop the compressor. Carry out after stop routines on compressor and system.

Total hours: 40

Semester 5

15ETN040 Wave Hydrodynamics 3 0 0 3

Course Objective: To develop student's ability to understand classification of ocean waves, wave energy, regular and irregular seaway, wave spectra and forces on the coastal structures, Wave load on vertical, inclined and horizontal cylinders, Breakwaters, Seawalls. - Model experiments, etc.

UNIT I Introduction to Waves 9

Waves: Classification of water waves – two dimensional wave equation and wave characteristics - Wave theories – small amplitude waves – Stokian, solitary and conoidal wave theories.

UNIT II Wave Kinematics 9

Water particle kinematics – wave energy, power – Wave deformation – Reflection, Refraction, Diffraction, Breaking of Waves – Wave forecasting Methods – Spectral description of Ocean Waves – Design Wave

UNIT III Wave Analysis 10

Ocean Waves - Wind generated waves, regular wave theory, waves to Finite Height, Trochoidal Waves, Group Waves, Irregular Seaway, Point and Direction Spectra's, Wave slope Spectra, Encounter Frequency Spectra. Idealised Spectral Families.

UNIT IV Currents 5

Currents: Classification – Behaviour – Design criteria, Scour and other effects of currents.

UNIT V Wave Forces 12

Forces: Wave forces – Morison equation – Wave load on vertical, inclined and horizontal cylinders, Diffraction theory – Wave slamming and slapping – Wave impact pressures and forces on coastal structures – Breakwaters, Seawalls. - Model experiments.

Total Hours: 45

TEXT BOOKS

1. K J Rawson and E C Tupper "Basic Ship Theory", Longman, 1976
2. ME McCormick "Ocean Engineering Wave Mechanics" –, Wiley Interscience, 1973.
3. B Le Mehaute "An Introduction to Hydrodynamics and Water Waves" , Springer- Verlag, 1976

REFERENCE BOOKS

1. W G Price and R E D Bishop "Probabilistic Theory of Ship Dynamics" , Chapman- Hall .1974
2. NDP Barltrop and AJ Adams "Dynamics of Fixed Marine Structures" –, Butterworth Heinemann, 1991
3. "Global Wave Statics" – ed. British Maritime Technology Ltd, Unwin, 1986.
4. E.C. Tupper "Introduction to Naval Architecture" by, Butter worth Heinemann

Semester 5

15ETN041 Propulsion of Ships 3 0 0 3

Course Objective: To develop student's ability to understand propeller theory, interaction between hull and propeller, propeller efficiency, propeller design, propeller cavitation, Prevention of cavitation, Design for minimum cavitation, Cavitation tests, different types of propulsion devices, etc.

UNIT I Propeller theory 9

Propeller as a thrust producing mechanism; historical development; Screw propeller screw propeller geometry, sections, propeller drawing, construction details. Propeller theories- Momentum theory, Blade element theory, Circulation theory. Interaction between Hull and Propeller - Wake and wake fraction, Resistance augment and thrust deduction factor, propulsive efficiency in open water and behind conditions, hull efficiency, quasi propulsive coefficient, transmission efficiency; Powering.

UNIT II Propeller Cavitation 9

Cavitation - Types, Cavitation Number, Effects of cavitation, Prevention of cavitation, Design for minimum cavitation, Cavitation tests. Design of propellers - propeller families and series; Open water tests-Presentation of data, Kt-Kq diagrams, Design charts,:-Bp-δ, T-J, P-J charts. Use of charts in. propeller design and performance study; Selection of engines-diesel engine characteristics.

UNIT III Propeller Strength 9

Propeller strength - Materials and their qualities, strength calculation. Model testing of propellers- Test facilities, Laws of comparison, open. Water diagram self-propulsion tests-British and continental Methods.

UNIT IV Types of Propellers 9

Shrouded propellers-Action of propeller in a nozzle; wake fraction and thrust deduction fraction in nozzle, load factor of nozzles, design of propeller nozzle system, design charts. Controllable Pitch propellers-Advantages, special features in geometry, design aspects. Super cavitating propellers-application.

UNIT V: Other propulsion devices 9

Other propulsion devices- Vertical axis propellers, Water jet propulsion, Sail, Paddle Wheels, Electro magnetic propulsion, etc. Ship standardization trials.

Total Hours: 45

TEXT BOOKS

1. Lewis, E.U.; "Principles of Naval Architecture ", vol. II, (2nd Rev), SNAME, New Jersey, U.S.A
2. Rawson & Tupper, Basic Ship Theory, Butterworth-Heinemann publishers

REFERENCE BOOKS

1. Harvald S.A., "Resistance and propulsion of Ships", John Wiley & Sons.
2. Barnaby K; Basic Naval Architecture.

Semester 5

15ETN042 Marine Design 3 0 0 3

Course Objective: To develop student's ability to understand general aspects of marine activities, ship design methods, fixing of main dimensions, general arrangement, Design of hull form - conventional method of lines, Lifesaving equipments, Drilling Rig and submarine pipe line design etc.

UNIT I Introduction 12

Introduction - General aspects of Marine Activities, Transportation of cargoes, Marine services & Operations, Marine Industries, Engineering Economics in Ship Design. - Economic criteria, Initial cost, Operating cost, RFR; Owner's requirements.

UNIT II Methods of ship design 12

Methods of ship design - design using basic type ships, Design using coefficients, Design using iteration methods, design spiral; design categories (dead-weight carrier, capacity carrier, linear dimension ship).
Ship parameters - displacement, displacement coefficient, displacement
Equation, volume equation, solution of the cubic equation.

UNIT III Fixing of main dimensions 12

Ship dimension -length, breadth, depth, draught, form coefficients; shape of the hull, mass estimation - lightship mass - steel mass, outfit mass, engine plant mass; dead weight. Design of hull form - conventional method of lines, distortion of existing forms; stem and stern contours, Bulbous Bow.

UNIT IV General arrangement 12

General arrangement - Subdivision of the ship's hull and erections, arrangement of spaces, arrangement of tanks, superstructure and deckhouses, arrangement of engine plants, Cargo handling capacity. Hold capacity and stowage factor.

UNIT V Offshore systems 12

Marine System and Offshore Platform Equipment Design: Bilge and Ballast system, Ventilation system, Air conditioning and Refrigeration system, Berth and Offshore Mooring systems, Anchor handling system for ships and shore structures, storage and offloading systems, Firefighting system, Stern gear, Steering gear, Lifesaving equipments, Drilling Rig and submarine pipe line design

Total Hours: 60

TEXT BOOKS

1. Lewis, E.U; 'Principles of Naval Architecture' (2~d Rev.) Vol.III, 1989, SNAME
2. New York.
3. Schneekluth, H. Ship Design for Efficiency and Economy, Butterworths, 1987.

REFERENCE BOOK

1. Taggart; "Ship Design and Construction", SNAME Publications.
2. D' Arcangelo: Ship Design and Construction, SNAME Publications.

Semester 5

15ETN043 Ship Production-I 3 0 0 3

Course Objective: This subject will give an insight into the ship production activities in the shipyard, fabrication of various components of the hull, general description of the various machines, bending of rolled and built up sections, double bottom sections, etc.

UNIT I Introduction to Ship Building 9

Introduction to shipbuilding: - Structure of the shipbuilding process, special aspects of transport in shipbuilding, principles of flow line production in shipbuilding mechanisation, automation, numerical control, computer control, trends of future development; Relations with supply industry, pattern of the shipbuilding, location and layout of shipyards, area, labour and other sources, coastline etc.

UNIT II Material preparation 9

Data generation for shipbuilding process - generation of hull forms, generation of frame plan, shell plate development, generation of hull components, lofting, nesting. Storage and preparation of material - Introduction, material handling and storage, transport system in steel stockyard, material preparation (straightening of plates and rolled sections, shot blasting, prepainting), material preparation flow line devices and their control systems.

UNIT III Fabrication of component parts 9

Fabrication of component parts:- the cutting process - tools, physical-chemical background of the cutting process, mechanical cutting, devices for thermal cutting, general description of the various machines, photoelectric and NC-control devices, edge preparation, problems of accuracy; bending of rolled and built up sections ,general description of bending, control of the bending process, automation of bending; plate bending, uniaxial bending, biaxial bending (devices, cold bending, heat-line bending), possibilities of automated plate bending.

UNIT IV Assembly of ship structure 9

Assembly of Ship's Structure: Prefabrication - general remarks, basic problems of prefabrication, pattern of prefabrication, welding in prefabrication Sub-assemblies: built up T -bars, web frames, machine foundations etc.; Welding deformation and straightening; Prefabrication of flat sections - panels,' panel production line, preassembly of biaxial stiffened panels - welding procedures. Assembly of flat corrugated sections, flat sections with curvature - assembly jigs, welding process, its nature, theoretical background, strengthening of flat sections. Preassembly of volume units - preassembly of double bottom sections - different structural arrangements, variants of the assembly process, welding problems; Preassembly of side tank units - structural arrangement; Special assembly systems (ROTAS, GAMMA- Systems, etc.); Preassembly of the fore and aft end structure; Preassembly and outfit of superstructures.

UNIT V: Erection of ships hull 9

Erection of ship’s hull- General assembly methods, handling of –preassembled units in the erection area – cranes, heavy-duty truck: preassembly of blocks – special types, advantages and disadvantages; hull assembly – different methods of hull assembly auxiliary devices; welding in ship’s hull assembly – welding methods applied welding defects, welding deformation of the ships hull; quality control (X-ray tests etc) scaffolds.

Total Hours: 45

TEXT BOOKS

1. Eyres D.J., Ship Construction William Heinemann Ltd, London, 1982
2. Taggart; Ship Design and Construction, SNAME Publications
3. Ship construction for marine engineers Reeds marine engineering series, Volume 5
4. Rawson KJ and Tuper EC, Basic Ship Theory , Longman Publications ,1976

REFERENCE BOOKS

1. Storch R.Lee, Hammon C.P. & Bunch H.M.; Ship Production, Cornell Maritime Press, Maryland, USA, 1988
2. Dormidontov V.K; Shipbuilding Technology, Mir Publishers, Moscow.
3. D' Arcangelo , Ship design and construction , SNAME Publications

Semester 5

15ETN044 Advanced Offshore Engineering 3 0 0 3

Course Objective: The student will get understanding of oil and gas field development, deep water challenges, riser systems, platform types, remote operated vessels, Mooring lines -Typical mooring configuration, material and construction, anchors and ancillary equipment, static mooring analysis, etc.

Unit I Introduction of Oil and gas field 9

Oil and gas field development Options: Platform types, marine riser systems, current design trends and deep-water challenges.

Unit II Riser systems: 9

Flexible pipe structure and material, typical configurations, top tensioned vertical risers, hybrid risers. Flow assurance: multi-phase flow, deposition of solids, thermal management, corrosion. Riser analysis: governing equations, boundary conditions, natural frequency.

Unit III Mooring system 9

Mooring lines -Typical mooring configuration, material and construction, anchors and ancillary equipment, static mooring analysis.

Unit IV Vortex induced vibration 9

Vortex induced vibration: drag, vortex shedding, surface roughness, lift, Strouhal number, VIV assessment, fatigue life calculation.

Unit V Remotely operated vehicles 9

Remotely operated vehicles: ROV categories- Micro, mini, general, Light work class, Heavy work class, AVUs ROV-handling systems, construction and materials, navigation and control, ,

Total Hours: 45

TEXT BOOKS

1. BC Grewick, Jr. Construction of marine and offshore structure, CRC Press, 2000.
2. RD Blevins, Flow induced vibrations, Van Nostrand Reinhold, 1990.
3. N Barltrop, Floating structures: A Guide for design and analysis, OPL, 1998.

REFERENCE BOOKS

1. EE Allimendinger, Submersible vehicle systems design. SNAME, 1990.
2. HO Bordeaux, Buoy engineering, John Wiley, 1975.

Semester 5

15ETN045 Marine Engineering II 3 0 0 3

Course Objective: The student will get an understanding of the marine engine systems on board the ships such as pumps, and pumping systems, valves and valves types, air systems, Air compressors, boilers, heat exchangers, cooling, evaporators, deck machine and hull equipment etc.

UNIT I Pumps onboard ships 9

Marine and special duty pumps, Details of pumps for marine purpose viz. condenser circulating pumps. Condensate and drain pumps, boiler feed pumps, bilge and ballast pumps-rotary pumps- ejectors; purpose of ejectors --details of construction. Marine piping - various types of piping system fitted-in ships, Expansion arrangements for pipes, valves used in Marine Practice. Materials and corrosion in pipes-colour codes for pipes.

UNIT II Auxiliary system 9

Auxiliary systems – Air compressors, boilers, heat exchangers, cooling, evaporators, distillers; waste heat recovery systems, hot water, drinking water, cooling water and sea water systems. Fuel systems, lubricating oil system-filters, coolers; centrifuges and clariters: Bilge and Ballast systems - sewage disposal, Oily water separator, incinerator, galley Equipment.

UNIT III Deck machinery 9

Deck machine and hull equipment - mooring, anchor handling, cargo handling - dry Cargo handling equipment - winches, cranes, Cargo gears. patent hatch covers, bulk heads, liquid cargo, tanker cargo, pipe layout systems - loading – unloading - ventilation and cleaning of tankers, L.S.A. Boats& rafts, emergency equipment, water tight doors, stabilizers and bow thrusters.

UNIT IV Steering gear system 9

Steering gears in marine use - different types description construction, operation and maintenance. Shafting arrangements, stern tubes and, glands, - oil. lubricated stern tubes, - shaft seals shaft alignment. Thrust block - reduction gearing. Propulsion, - types for marine propulsion, constructional details, fixing, maintenance and operation. Ship, stabilizers; Engine room cranes, chain blocks; tackles; Anchors, anchor cables.

UNIT V Safety systems 9

Safety systems- fire fighting equipment, Instrumentation & Control, watch keeping system UMS classes-Air Compressors, heat exchanger. Refrigeration: Definition and purpose, Principle of operation of Simple vapour compression system. Representation on T.S. AND p-h charts. Estimation of coefficient of performance and refrigerant flow rate. Factors affecting coefficient of performance. Absorption refrigeration system, Comparison with vapour compression system. Principle of operation of vapour absorption system like aqua ammonia system, Electrolux system, Lithium bromide absorption refrigeration system etc-Steam jet refrigeration system-working principle. Refrigerants-Classification and designation-properties and requirements - Important refrigerants like NH3, CO2, Methyl chloride, Methylene chloride, Freonsetc. Factors influencing selection of refrigerants. Secondary refrigerants. Preparation of diagrams for various piping systems, steering gear, stem gear, Etc.

Total Hours: 45

TEXT BOOKS

1. Harrington; Marine Engineering, SNAME Publications
2. Pounder C.C; Marine Diesel Engines, Newnen - Butterworths, London.
3. Khetagurov, M; Marine Auxiliary Machinery and systems, Peace Publishers, Moscow.
4. Taylor, D.A.; Introduction to Marine Engineering

REFERENCE BOOK

1. Marine Engineering for Naval Architects, Vol 3, Reeds series

Semester 5

15ETN046 Ship Design Calculation Drawing & Drafting – III (SDCADD-III) 0 0 4 2

Course Objective: To develop student's ability to understand practically various ship design drawings such as weight curve, buoyancy curve, shear force and bending moment diagrams, longitudinal strength and transverse strength, Hull structure Lines Plan and Shell Expansion etc.

List of experiments

1. Longitudinal ship strength: the ship in calm water, wave bending, stresses due tobending,
2. Weight curve, Buoyancy curve, Shear force & Bending moment diagram
3. Other forms of fatigue
4. Endurance criteria (leakage, collapse, fatigue, bending).
5. Transverse strength of the ship
6. Watertight bulkhead design and drawing
7. Arrangement of watertight and non-water tight penetration
8. Loading and unloading-longitudinal strength calculations.
9. Bending and buckling of beams
10. Equivalent width of bending plates.
11. Plates under bending forces and Plates buckling.Study and design of reinforced plates.
12. Hull structure Lines Plan and Shell Expansion

Total Hours: 40

Semester 5

15ETN047 Software Lab - DnV SESAM 0 0 3 2

Course Objective: To develop student's ability to understand offshore structural design and analysis software, DnV SESAM and undergo the software practicals in various modules for the design of the offshore structure.

List of experiments

1. Introduction to SESAM Jacket Structure modeling
2. Creating Sections
3. Creating Materials
4. Creating Jacket legs
5. Creating Topside structure
6. Joints Modeling
7. Load case Analysis
8. Environmental modeling
9. Soil and pile modeling

Total Hours: 40

Semester 5

15ETN048 Ship Visit and Report 0 0 2 1

Course Objective: The visit will familiarize the student various parts of the ship including decks, compartments, equipment fitted on boards, anchoring system, Access arrangements, mooring system, Accommodation area, Location of various tanks and their usage, etc.

The student shall be taken to visit a shipyard / ship and they have to visit various compartments and decks as follows:

1. Upper deck, second deck and lower decks.
2. All the equipment fitted on the decks (like windlass, capstan, winches, cranes, bitts, Bollards etc.
3. Engine room (the main engine and auxiliary engine, compressors, feed pumps, fuel oil pumps, exhaust system, and other accessories)
4. Location of various tanks and their usage.
5. Access arrangements (ladders, gang ways)
6. Accommodation areas
7. Equipments used for anchoring and mooring (Ground tackle equipments like anchor, anchor chain, wire rope, shackles, chain stoppers) chain lockers etc.
8. Bulwark and guard rails
9. Communication equipments
10. Fendering
11. Cargo holds
12. Doors, hatches and man holes.
13. Bulk heads.
14. Wheel house and wheel house equipments.
15. Mast and navigation lights.
16. Steering gear compartment.
17. AC & Refrigeration equipments.
18. Propeller shaft system.
19. Piping and valves.
20. Electrical equipments, like generators, motors, control panel etc.

After the visit the students shall submit a report for evaluation.

Total Hours: 40

Semester 6

15ETN049 Sea keeping of Ships and Offshore Structures 3 0 0 3

Course Objective: To develop the student's capability to understand the sea keeping aspects of the ships and offshore structures, ships motion control in the sea way, use of stabilizers, and dynamics of the floating offshore systems, dynamic effects of ship in seaway, etc.

UNIT I Coordinate system **9**

Ship in Regular Waves - Co ordinate Systems, Equations and Motion (uncoupled Heave, Pitch and Roll; Coupled Heave and Pitch) Hydrodynamic Forces, Radiation Forces, Strip Theory.

UNIT II Dynamic effects of ship in seaway **9**

Ship in Seaway and Dynamic effects - Linear Superposition, Response Amplitudes Operator, Pitch and Roll in irregular Waves, Local and Relative Motions shipping of green water, Slamming, Yawing and Broading, Added Resistance, Powering in Waves, Wave Loads.

UNIT III Ship motion control **9**

Ship Motion Control - Control of Roll - Passive Stabilizers (Bilge keel, Sails, Free Surface Tanks, U-tanks, Moving weight) Controlled - Passive Stabilizers, Active Stabilizers (fin, gyro, active-tank) Rudder stabilization, Control of Pitch .

UNIT IV Sea keeping performance criteria **9**

Sea keeping Performance and Design Aspects - Sea - keeping performance criteria and ship seaways responses, factors affecting pitching, heaving and rolling, guidelines for design.

UNIT V Dynamics of floating system **9**

Dynamics of floating systems: Equations of motion for SDOF Systems, Time and Frequency domain solutions - Oscillators of Floating Bodies, Added Mass and Moment of Inertia, and Hydrodynamic damping - Exciting Forces and moments due to Waves. Strip theory for Slender Bodies - Symmetric and Unsymmetric Coupled Motions Effect of Forward Speed - 3D Effects - Dynamic Effects - Roll and Pitch Damping Devices - Probabilistic Approach - Introduction to Random Response Theory Random Response of linear, Systems under wave Loading, Directional Spectra for Waves - Probabilistic Design Criteria - General Motion Analysis of Floating Bodies, Time and Frequency Domain Approach.

Total hours: 45

TEXT BOOKS

1. Lewis E.U; "Principles of Naval Architecture" (2nd Rev) Vol. III**,** 1989, SNAME Newyork.
2. Bhattacharya.R; "Dynamics of Marine Vehicles" 1978, Wiley Inter Science, Newyork.

REFERENCE BOOKS

1. Lamb.H; "Hydrodynamics", 1945 Cambridge University Press, UK.
2. Newmann.J.N; "Marine Hydrodynamics".MIT Press, USA ,1977
3. Newmann J.N; "Theory of Ship Motions Advanced Applied Mechanics", 1980
4. Price W.G & Bishop R.E,; "Probability Theory of Ship Dynamics",Chapman & Hall, London1982.

Semester 6

15ETN050 Structural Design of Ships 3 0 0 3

Course Objective: This subject will give the student the knowledge about ship building materials, ship structural design concepts, structural components of the ship and the design aspects, general considerations, external loads, framing systems, structural design procedure, etc.

UNIT I Shipbuilding materials 9

Shipbuilding materials – transition from wood to steel, ship building quality steels (Properties grades), joining techniques – riveting, welding, different type of joints – butt joint, fillet joint, lap joint, welding symbols, weld strength

UNIT II Ship structural design concepts 9

Ship structural design concepts –specialisation of the structure, general considerations, external loads (review), and structural analysis models, design criteria steps in structural design procedure, design from first principles, and design according to classification rules

UNIT III Ship structural systems 9

Ship structural systems) Ship as stiffened plate structure – framing systems, common stiffeners sections corrugated constructions, design of strakes (butt & seams), welding sequence, shell expansion , Structural subsystems – bottom structure, side shell structure, deck structure, bulkhead structure, super structure etc.

UNIT IV General structural arrangements 9

General structural arrangements of different type of ships (historical review), sub- assembly, stiffened panels and volume sections. Type, functions, framing systems, components & scantlings, structural connections of components: - Bottom structure (Double & single bottom, openings, bilge keel), side structure, deck structure (hatchways, pillars, bulwarks, guardrails, fenders) bulkhead structure fore & aft end structure, panting & pounding arrangement, compatibility of bottom and side, side and deck, deck and bulkhead, side and bottom, engine room (engine foundation, casing, structural design) super structure, deck house (effectiveness, structural design, openings, expansion joints etc.

UNIT V Cargo handling systems 9

Cargo handling equipment – different systems, mast derrick system, loads calculations on mast derrick system, design of mast derrick system, deck cranes. Hatch covers – functions, load, statutory requirements, types, cleating and sealing arrangements, pontoon covers design. Construction of lifeboats, submarine structure, chain locker hawse pipe, rudder types and their construction. Nozzles, stern tube and bossing. Design of fore and aft end structure. Structural design of rudder. Design of machine foundations, Superstructure etc. Design of bulkhead, Midship section, shell expansion.

Total Hours: 45

TEXT BOOKS

1. Taggart: Ship Design and construction, SNAME publications
2. Eyres D.J.; Ship Construction William Heinemann Ltd, London, 1982

REFERENCE BOOKS

1. D'Arcangelo: Ship Design and construction, SNAME publications
2. Owen Hughes, Ship Structural design, SNAME publications

Semester 6

15ETN051 Structural Design of offshore Structures 3 0 0 3

Course Objective: To develop the student's ability to carry out offshore structure design calculations, and understand the various aspects of the design covering design loads, tension and compression members, plates and beams, design of cylindrical members, design of tubular joints, etc.

UNIT I Planning of Offshore Structure design 9

Planning of Offshore Structures; Design criteria and procedures – WSD and LRFD, Design loads – dead loads and live loads, load combinations: Determination of wave, wind and current loads.

UNIT II Design of plates and beams 9

Design criteria of plates and beams – considerations - Design of tension members and compression members - Materials used for plates and beams- Analysis of loading on beams and plates.

UNIT III Design of cylindrical members 9

Design of cylindrical members – axial compression, biaxial bending and combined loads; Hydrostatic implosion.

UNIT IV Design of Tubular joints 9

Design of Tubular joints – Punching shear method and calculation of allowable joint capacity; stress concentration factor, Fatigue analysis and Design – SN curve method.

UNIT V Pile Design 9

Pile Design – Pile Capacity for axial bearing loads and axial pull out loads; Soil reaction for axially loaded piles and laterally loaded piles; Structural Design of piles.

Total Hours: 45

TEXT BOOKS

1. Hand book of Offshore Engineering – S.K. Chakrabarti, Elsevier Publications 2005.
2. Offshore Structural Engineering – Dawson T.H. Printice Hall, 1983.

REFERENCE BOOKS

1. API RP 2A WSD 1993
2. API RP 2A LRFD 2000

Semester 6

15ETN052 Finite Element Methods 3 0 0 3

Course Objective: To impart the student with the basic knowledge about finite element analysis of structural elements which will be useful for the design of ships and offshore structures. This subject covers one dimension and two dimension FEM, isometric elements, analysis of plates and application of FEM.

Unit I Introduction 9

Concepts of FEM - steps involved - merits and demerits - energy principles Discrimination - Raleigh - Ritz method of functional approximation. Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress,plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

Unit II One dimensional and Two Dimensional FEM 9

One dimensional FEM: Stiffness matrix for beam and bar elements - shape functions foe ID elements.
Two dimensional FEM: Different types of elements for plane stress and plane strain analysis displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices

Unit III Isometric elements 9

Concept - different Isoparametric elements for 2D analysis -formulation of 4-noded and 8-noded Isoparametric quadrilateral elements - Lagrange elements - serendipity elements. Axi Symmetric Analysis: bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements.Three dimensional FEM: Different 3-D elements-strain-displacement relationship –formulation of hexahedral and Isoparametric solid element.

Unit IV Analysis of Plates 9

Introduction to Finite Element Analysis of Plates: basic theory of plate bending - thin plate theory - stress resultants - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element.

Unit V Applications of FEM 9

Introduction to non – linear analysis – basic methods – application to Special structures.

Total hours: 45

Text Books:

1. Robert D.Cook, David S, Malkus and Michael E. Plesha, “Concepts and Applications of
2. Finite Element Analysis” Wiley, 1989.
3. OC Zienkiewicz, “ Finite element Methods” Butterworth Heinemann, 5th edition , 2002
4. GS Krishna Murthy, “Finite element analysis, theory and programming” 2nd edition, Mcgraw Hill publishing.

Reference Books:

1. Tirupathi Chandra Patila and Belugunudu, “Introduction to Finite elements in engineering” Pearson Education Limited, 2014
2. JN Reddy, “Introduction to Finite element Method”, McGraw-Hill, 2006.

Semester 6

15ETN053 Ship Production-II 3 0 0 3

Course Objective: The student will get an insight into the various type of launching methods, launching calculations, outfitting activities onboard the vessel, including installation of machinery, shafting, propeller, cabling, basin trials, sea trials, contractual obligation etc.

UNIT I Launching methods 9

Launching – general method, launching by floating off (building dock, launching dock, floating) mechanical launching methods (slip, life) launching from inclined building berths – stern launching, launching calculations model and large scale-experiments

UNIT II Outfitting of ships 9

Out fitting of ships: - workshops – piping shop, fitting shop, Carpenters Shop (wood, plastic), Mechanical workshop, Machine Shop (preassembly of blocks). Other workshops (electrical installation, painting insulation, etc.); Technology process in the hull installation work – technological process in installing the main machinery,

UNIT III Installation of machinery 9

installation of shafting and propeller, installation of the main machinery, installing of auxiliary machinery and boilers, installation of piping systems, electrical installation, hull installation work; pre and advanced outfitting.

UNIT IV Basin trials 9

Installation inspection of all machinery by surveyors, AC and ventilation system trials, generator trials, trials of all pumps, steering gear trials, trials of life boat lowering and hoisting, anchor trials, main engine trials, etc.

UNIT V Sea Trials 9

Carry out all the above trials at sea, run the main engine at various regimes, record performance, endurance trials of main engine, maneuvering trials, speed trials to prove the contractual obligation.

Total hours: 45

TEXT BOOKS

1. Lewis E.U; "Principles of Naval Architecture" (2nd Rev) Vol. III**,** 1989, SNAME, Newyork.
2. KJ Rawson and EC Tupper, “Basic Ship Theory”, Longman, 1976.

REFERENCE BOOKS

1. Taggart. “ Ship Design and construction” SNAME Publication
2. EC Tupper, “Introduction to Naval Architecture”, Butter worth Heineman

Semester 6

15ETN054 Ship Design Calculation Drawing & Drafting – IV (SDCADD-IV) 0 0 3 2

Course Objective: To understand and develop student's ability to carry out practically ship designing calculations including resistance calculation, selection of propeller, shaft line drawing, sea keeping calculation, basics of ship vibrations, equipment Foundation design, Location of manholes and bottom plugs, etc.

List of experiments

1. Ship resistance (frictional and wavemaking resistance, form resistance)
2. Resistance and power curves(on graph sheet)
3. Calculation of ship resistance and propulsion
4. Choice of propeller of evaluation of propulsion
5. Propulsion power estimation
6. Design of propellers and propeller drawing
7. Shaft line drawing
8. Sea keeping calculation (ship maneuverability)
9. Types of rudder, Design of rudder and drawings
10. Basics of ship vibrations.
11. Arrangement of cargo holds, engine room, tanks, accommodation area, and out fittings
12. Door plan, Design & drawing of various types of doors and hatches
13. Equipment Foundation design, AV Mounting
14. Windows and scuttle plan
15. Location of manholes and bottom plugs
16. Types and arrangement of ladders
17. Types and arrangement of access openings
18. Design and drawing of loose tanks

Total Hours: 40

Semester 6

15ETN055 Seamanship Lab 0 0 3 2

Course Objective: To familiarize the students with seamanship terminologies, tools and equipments used on board the ship, fire fighting and life saving appliances, types of anchors, parts of anchors, type of flags, fenders and materials, types of ropes and knots, etc.

List of experiments

1. Types of ropes and knots
2. Types anchors, parts of anchors
3. Life saving appliances
4. Fire Fighting appliances
5. Parts of ship
6. Main mast/Arial
7. Type of flags
8. Parts of main mast
9. Type of fenders & materials
10. Mooring Lines & types
11. Gangway
12. Anchors and chain cables, chain locker

Total Hours: 40

Semester 6

15ETN056 Minor project 0 0 3 2

Course Objective: To develop student's ability to understand and carry out project work on a chosen topic independently and submit for evaluation. This will enhance the student's independent thinking and ability to work independently on selected topic and carry out research work later.

The students will be allotted minor project from the department and they will have to complete the project and submit the report for evaluation.

Total Hours: 40

Semester 7

15ETN057 Dynamics of Offshore Structures 3 0 0 3

Course Objective: To develop student's ability to understand the basic feature of dynamic loading and structural response, Formulation of equation of motion, principle of virtual displacement and Hamilton's principle degrees of freedom, mass moment of inertia, responses to impulse loading, Fourier series loading and response, etc.

Unit I Overview **9**

Over view:- Basic features of dynamic loading and response – models for dynamic analysis – lumped mass, generalized displacements and finite element models. Formulation of equation of motion, principle of virtual displacement and Hamilton's principle. Degrees of freedom – Translational and rotational systems - mass moment of inertia

.

Unit II Solution to equation of motion **9**

Free vibration of single degree of freedom system:- Solution of equation of motion, undraped free vibration - Damped free vibration, critically damped, under damped and over damped systems, Negative damping. Single degree of freedom system – Response:- Response to harmonic loading, Undamped system- damped system, Response to periodic loading -Fourier series expansion of the loading- response to Fourier series loading Exponential form of Fourier series loading and response- Complex frequency transfer functions

Unit III Response to dynamic loading **9**

Response to impulsive loads: - Suddenly applied load, sine wave impulse, rectangular impulse, triangular impulse, spike loading, approximate analysis Response to general dynamic loading:- Duhamel integral for undamped system – unit impulse response function numerical evaluation, response of damped system- numerical evaluation, Numerical analysis in the frequency domain, fast Fourier transform analysis.

Unit IV Multi degree of freedom system **9**

Multi degree of freedom system:- Two degree of freedom system – equation of motion, characteristic equation, frequencies and mode shapes, coordinate coupling and choice of degree of freedom, orthogonality of modes, natural coordinates, superposition of natural modes , response of two degree of freedom system to initial excitation, beat phenomenon, response to harmonic excitation.

Unit V Matrix methods for dynamic analysis **9**

Analysis of multi- degree of freedom system- Rayleigh - Ritz, Stodola and Holzer methods, Matrix methods for dynamic analysis, mode superposition analysis. Practical Vibration Analysis:- Determination of frequency by Rayliegh's method. Beam flexure – selection of shape- improved Rayleigh's method,solid interaction, dynamicbehaviour of offshore towers. stochastic dynamics of offshore structures, frequency domain response - Narrow band systems, fatigue predictions - Response to wave, and earthquake loadings.

Total Hours: 45

TEXT BOOKS

1. Clough,R.W. and Penzien, J., Dynamics of structures, McGraw Hill, 1993.
2. Chopra, A.K., Dynamics of structures – Theory and Application to Earthquake Engineering, Prentice Hall of India, 1996.
3. James F. Willson, Dynamic of offshore structure, John Wiley & Sons Inc.

REFERENCE BOOKS

1. Criteria for Earthquake Resistant Design of Structures, 2002.
2. SP 22: Explanatory Handbook on Codes for Earthquake Engineering.
3. Meirovitch L., Elements of Vibration Analysis, Mc.Graw Hill, 1986.
4. Thomson W.T., Theory of Vibration with Applications, Pearson Education Inc., 1998.
5. Craig, Jr. R.R., Structural Dynamics, John Wiley, 1981.
6. Hurty, W.C. and Rubinstein M.F., Dynamics of Structures, Prentice Hall, 1964.

Semester 7

15ETN058 Constructability of Offshore Structures 3 0 0 3

Course Objective: To develop student's ability to understand practical aspects of fabrication and construction of offshore structures, Deep sea operations, Phenomena for Deep-Sea Operations, Properties of Materials for the Deep Sea, Platforms in the Deep Sea, launching, Removal of Offshore Platforms, Removal of Piled Structures, etc.

Unit I Introduction 9

Introduction to constructability, Construction stages for offshore structure. Principle of constructability, Facilities and methods for fabrication, Launching, Assembly and Jointing Afloat, Material Selection and procedures, Access, Tolerances, Survey control, Quality control and assurance, safety, Control of construction: Feedback and Modification, Contigency Planning, Manuals, On-site Instruction Sheets, Risk and reliability Evaluation.

Unit II Construction in deep sea 9

Construction in deep sea, Considerations and Phenomena for Deep-Sea Operations, Properties of Materials for the Deep Sea, Platforms in the Deep Sea: Compliant Structures: Guyed Towers, Compliant (Flexible) Tower, Articulated Towers, Tension-Leg Platforms (TLP's), SPARS, Ship-Shaped FPSOs, Deep-Water Moorings, Construction Operations on the Deep Seafloor, Deep-Water Pipe Laying, Seafloor Well Completions, Deep-Water Bridge Piers.

Unit III Decommissioning of offshore platform 9

Removal of Offshore Platforms, Removal of Piled Structures (Terminals, Trestles, Shallow-Water Platforms), Removal of Pile-Supported Steel Platforms, Removal of Concrete Gravity: Base Offshore Platforms, New Developments in Salvage Techniques, Removal of Harbour Structures.

Unit IV Marine structures in arctic sea floor 9

Arctic Marine Structures, Sea Ice and Icebergs, Atmospheric Conditions, Arctic Seafloor and Geotechnics, Oceanographic: Ecological Considerations, Logistics and Operations, Earthwork in the Arctic Offshore, Ice Structures.

Unit V Pipeline installation 9

Steel and Concrete Structures for the Arctic: Steel Tower Platforms, Caisson-Retained Islands, Shallow-Water Gravity-Base Caissons, Jack-Up Structures, Bottom-Founded Deep-Water Structures, Floating Structures, Well Protectors and Seafloor Templates, Deployment of Structures in the Arctic, Installation at Site, Ice Condition Surveys and Ice Management, Durability, Constructability, Pipeline Installation, Current Arctic Developments

Total Hours: 45

TEXT BOOKS

1. API RECOMMENDED PRACTICE 2A-WSD, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design
2. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.
3. Subrata K Ckakrabarti, "Handbook of Offshore Engineering", Vol 1, Elsevier Publishers, 1st edition, 2005.
4. Subrata K Ckakrabarti, "Handbook of Offshore Engineering", Vol 2, Elsevier Publishers, 1st edition, 2005.

REFERENCE BOOKS

1. Libros y Manuales de Ingenieria, Construction of Marine and Offshore Structures, Third Edition.

2. McClelland, B &Reifel, M.D., Planning & Design of fixed Offshore Platforms, VanNostrand, 1986

3. Graff, W.J., Introduction to Offshore Structures, Gulf Publ. Co. 1981.

Semester 7

15ETN059 Marine materials and metal joining techniques 3 0 0 3

Course Objective: To impart knowledge to the student on joining techniques of various metals including steel, aluminum and non-ferrous materials, Classification of materials, mechanical testing, alloying, steels, non-ferrous alloys, plastics, ceramics, composites which are used for ship construction, Welding standards, Welding procedure qualification, etc.

UNIT I CLASSIFICATION OF MATERIALS 9

The equilibrium phase diagrams, structures, and properties of common engineering materials with emphasis on mechanical testing methods, heat-treatment, international standard specifications, selection and applications of such materials. Classification of materials, mechanical testing, alloying, steels, non-ferrous alloys, plastics, ceramics, composites

UNIT II WELDING AND WELDING METHODS 9

General principles for welding, welding methods, welding metallurgy, welding symbol, weld design, welding procedure specifications and qualifications, pipeline welding, Different welding methods and associated defects-Weld defects, Distortion, accuracy control; Non destructive tests Welding quality control- Welding standards, Welding procedure qualification, Effect of variables on qualification of tests, Performance Qualification of welders and operators, Test Reports. Acceptance standards, Quality assurance and audit, Consumable, classification and coding. Knowledge of WPS and the corresponding WPQR, Welding of stainless steels. Surface preparation for steel, aluminum and other materials used in marine structures. Introduction to welding for offshore applications.

UNIT III MATERIAL FOR CONSTRUCTION 9

Materials used in Marine Construction of fixed offshore structures in Marine Environment, Materials used in Marine Construction of Floating structures in Marine Environment - (Floaters - permanent and mobile). Materials used in Marine Construction of Underwater vehicles/ Remote operated Vehicle/ Remote operated tools in subsea operations and Deep water operations. Materials used in Marine offshore drilling units'– Mooring Lines and risers both production risers, drilling risers. Flow line / pipeline / Deep water riser system/ flexible risers. Materials used in Marine Construction of Ship and Ship structures, Boat, Launches, Composite construction of FRP/GRP, Superstructures Deckhouse structures, Aluminum, Steel - their materials involved in constructions … etc. Pipes- stainless steel, seamless pipes, Fabricated pipes, PVC, Properties of Structural elements/ section materials, construction materials, Propeller, Rudder, Anchor chain cable Hawse pipe, etc. Classification Society rules for Materials, Outfitting Material of ship and floaters. Selection of materials and fabrication control of steel structures, Selection of materials and fabrication control of aluminum structures, Selection of materials and fabrication control of concrete structures and steel structures, Corrosion protection of structures and Condition monitoring of structures

UNIT IV WELDING PROCESS 9

Gas metal arc welding - process, different metal transfers, power source, electrodes, shielding gas, uses of gas in metal arc welding, Mechanized system in shipbuilding - Introduction, Philosophy of automation in welding, different welding system on shipyards, welding in production shop - SAW. Gravity, welding, Auto contact, CO2 Welding - One -sided welding - SAW. MIG welding, welding of stiffeners. Welding in building berth - external welding on the berth, Electro-slag welding, Electro - gas welding, one side welding (flux Asbestos backing, Ceramic backing etc); Internal welding on the berth.

UNIT V NONDESTRUCTIVE INSPECTION OF HULL & PIPE WELDS 9

NDT Procedures and Techniques, Acceptance Standards, Documentation, Radiographic Inspection: General, Surface Condition, Radiographic Procedure, Film Identification, Radiography Quality Level, Image Quality Indicator, Radiographic Density, Radiographic Film Quality, Radiographic Film Interpretation , Storage of Radiographs, Extent of Radiographic Inspection, Location of Radiographic Inspection, Applicable Criteria, Acceptance Criteria, Ultrasonic Inspection:-General Requirements, Procedure, Extent of Ultrasonic Inspection, Location of Ultrasonic Inspection, Applicable Criteria, Acceptance Criteria, Ultrasonic Inspection of Full Penetration Tee and Corner Joints

Total Hours: 45

TEXT BOOKS

1. V Raghavan; Material Science and Engineering, Prentice Hall of India (P) Ltd, NewDelhi
2. Richard, little; Welding Technology, McGraw Hill Publications, New Delhi.
3. O.P.Khanna; A Textbook of Welding Technology, Dhanpat Rai & Sons.

REFERENCE BOOKS

1. Hanson ; The Engineer's Guide to Steel, Addision - Wesley publication Company, Inc
2. Davies, A.S.; Welding Cambridge University Press, Low Price Edition, 1996:
3. Joe Lawrance; Welding Principles for Engineers, Prentice - Hall Inc. Englewood cliffs, N.J.
4. Hand Book of American Welding Society AWS

Semester 7

15ETN060 Controllability of ships and Offshore Structures 3 0 0 3

Course objective: To help the student to understand maneuvering fundamentals, control surface hydrodynamics, control surface design, determination of hydrodynamic derivatives, various types of maneuvers, dynamic positioning of offshore structures and their control, etc.

UNIT I Maneuvering Fundamentals 9

Maneuvering Fundamentals – the control loop, path keeping, equations of motion linearised equations and control fixed stability indexes, model tests. Stability and control in the horizontal and vertical planes – definitive manoeuvres, turning trails. Control Surface Hydrodynamics – geometry of control surface rudder, flow around rudder, aspect ratio, influence of hull shape on aspect ratio, influence of fixed structures.

UNIT II Control Surface Design 9

Control Surface Design – specification of requirements and constraints on rudder design, rudder location and orientation, number of rudders, type of rudder, geometric properties of rudder, maximum rudder deflection angle and deflection rate, rudder stock location. Influence of ship features on controls fixed stability – Fixed fin, Propeller, Hull, Configuration.

UNIT III Hydrodynamic derivatives 9

Experimental determination of hydrodynamics derivatives (rotation arm technique, planer motion mechanism). Non-Linear Maneuvers, Simulation, IMO Rules and Recommendations.

UNIT IV Maneuverability 9

Introduction to Maneuverability, control, fixed and control working motions stability, Hydrodynamic stability and motion stability criterion, spiral, Zigzag and overshoot maneuvers and turning circle maneuver, Heeling while turning, Maneuvering in restricted water and autopilot ITTC maneuvering standards.

UNIT V Control surface design 9

Design of control surface rudder design. Mooring Dynamic Positioning of Offshore Structures, Control, etc. Calculation of free stream characteristics of rudder, Rudder Design, Zigzag maneuvers.

Total: 45Hours

TEXT BOOKS

1. Lewis E.U. “Principles of Naval Architecture”, (2nd Rev) 1989, SNAME, New Jersey, U.S.A.
2. Rawson KJ and Tuper EC 1976 , Basic Ship Theory, Longman Pubications

REFERENCE BOOKS

1. Abkowitz.M.A. “Lectures on ship Hydrodynamics – Steering and Manoeuvrability” 1964, Danish Technical Press, Copenhagen, Denmark.

Semester 7

15ETN061 Standards and Recommended Practices 2 0 0 2

Course Objective: This course will enable the student to understand the various standards and rules available for the design of ships and offshore structures. The rule includes ILO and ILLO regulations, Standards of Training, Certification and Watch keeping, etc.

UNIT I IACS and IMO regulations 9

International association of classification society (IACS AND MEMBERS IN IACS), International Martime Organization (IMO), Marine Pollution(MARPOL), Safety of life at sea(SOLAS).

UNIT II ILO and ILLO regulations 9

International Labour organisation(ILO) – International Regulations for Preventing Collisions at Sea (COLREG) –(ILLO) – (IMS) – The International Ship and Port Facility Security (ISPS)

UNIT III STCW regulations 9

Standards of Training, Certification and Watch keeping for Seafarers(STCW) – SHIP RECYCLING – Emergency Position Indicating Radio Beacons (EPIRB) – Global Maritime Distress and Safety System (GMDSS)

UNIT IV Recommended practices 9

Offshore Rules, MODU Rules, API CODE – DNV RP Codes And Recommended Practices, NORSKE Standards

UNIT V Offshore codes 9

API 16Q for drilling riser - API 2RD for production Riser - API 17 A Design and operation of subsea production system - API 17 B for Flexible pipes, API 17 C to K - ISO 13628 Design and operation of subsea system – AWS – NACE - IMO

Total: 45 Hours

TEXT BOOKS

1. IMO Publications and documents
2. Dawson, T.H., Offshore Structural Engineering Prentice Hall, 1983
3. API RP 2A., Planning Designing and Constructing Fixed Offshore Platforms, API
4. McClelland, B & Reifel, M.D., Planning & Design of fixed Offshore Platforms, VanNostrand, 1986

REFERENCE BOOKS

1. Graff, W.J., Introduction to Offshore Structures, Gulf Publ. Co. 1981.
2. Reddy, D.V & Arockiasamy, M., Offshore Structure Vol.1 & 2, Kreiger Publ. Co 1991
3. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.

Semester 7

15ETN062 Ship Design Calculation Drawing & Drafting – V SDCADD-V 0 0 3 3

Course Objective: To develop student's ability to understand practical aspects of ship design drawings, piping system diagram, painting surface area calculation, HVAC schematic diagram, weight estimation, life saving plan, compressive air system, ballast system, etc.

List of experiments

1. Pipe Design- Piping diagram for fluid systems of a ship.(Sanitary supply & discharge, Fuel oil system, lube oil system, Sea water cooling and fresh water cooling, compressed air system, Bilge and ballast system, drain pipe internal /external, etc.)
2. Electrical Circuit – Schematic Diagram & Load calculation
3. HVAC Schematic diagram
4. Wetted surface area calculation
5. Painting surface area calculation
6. Weight estimation, material estimation
7. Structural fire protection plan, Fire control and safety plan
8. Arrangement of life saving plan
9. Arrangement of exits
10. Anchor arrangement
11. Mooring arrangement
12. Mast Design
13. Field of vision
14. Navigational light arrangement
15. Antenna arrangement
16. Sounding pipe arrangement
17. Air ventilation system
18. Cathodic protection plan
19. End launch calculation, End launching curves(on graph sheet)
20. Docking plan, Docking calculation Welding schedule

Total Hours: 40

Semester 7

15ETN063 Software Lab – PDMS/ NAPA/ SACS etc 0 0 3 2

Course Objective: To develop student's ability to understand and carry out practice in softwares like PDMS, NAPA, SACS, etc. so that the student is capable of using the softwares in the ship /offshore engineering. The modules will include working plane, construction lines, positioning of equipments, orientation of pipe lines, etc.

UNIT I Basics and general utilities 9

Introduction about piping & PDMS, Modules, Login, etc., Working with 3D view, using command window, Clash detection representative tools, working plane, construction lines.

UNIT II Create and modify equipment 9

Creating Primitives, Creating Standard Equipment Utilities, Attributes, Attributes Global, Hierarchy, Create primitives using command window, Dragging and Orientation of Equipment. Modify Standard Equipment, Properties, Equipment Specification, Nozzle Specification, Positioning Equipment, Model editor, etc.,

UNIT III Pipe Work Modeling 9

Pipe work Hierarchy, Pipe Work Orientation, Create branch, connecting pipe, placing pipe, branch replacing, Pipe create by model editor, pipe creation by command line, pipe insulation, material selection of pipe, create co ordinate piping.

UNIT IV Modify Pipe Routing 9

Modify branch, Modify specification, Modify orientation, Reselect of branch, branch explicit, modify connection type, modify BOP/TOP, Dragging pipe ,route splitting , change co ordinate.

UNIT V Piping system Orientation 9

Pipe sloping, auto sloping, component orientation, sloping and falling of pipe, line stub. Data consistency, clash checking, Type of clash checking, check flow of piping, Piping reference, piping connection, isometric production, branch splitting material take off rectification of pipe routing error

Total Hours: 45

Semester 7

15ETN064 Shipyard Training 0 0 2 1

Course objective: The students will be attached to various shop floors in the shipyard to observe and study the shipyard practices during the summer vacation. The student will be able to see for himself production of ship and offshore structure at various stages. They are to submit their workbook on completion of shipyard attachment.

They will study and familiarize themselves with the following,

1. Shipyard Layout
2. Shipyard Organization Chart
3. Dry-dock Layout
4. Services in dry dock
5. Types of dock blocks
6. Dry dock gate arrangements
7. Various stages of hull erection
8. Plate preparation arrangement
9. Types of plate surface preparation
10. Mechanical engineering workshops
11. Electrical workshop
12. Out fitting arrangement in the out fitting wharf

Total Hours: 40

Semester 7

15ETN065 Major Design Project-Phase-I 0 0 2 1

Course objective: The student will be able to carry out data collection, collation, and design calculations independently with the help of the guide. The student will have to choose any ship or offshore engineering project for design work. They have to complete the preliminary calculation up to fixing of main dimensions and preliminary checks. Detailed design will be carried out in phase II of project.

Total Hours: 40

Semester 8

15ETN066 Marine Hydrodynamics & Ocean Engineering Lab 0 0 4 2

Course Objective: The student will understand practical aspects of carrying out hydrodynamic model tests and ocean engineering lab practicals so that he is very much confident about design aspects of ships as well as offshore structure.

The students will witness the following hydrodynamic lab test in the towing tank

1. Model test to predict ship resistance, flow line test, shallow water resistance test.
2. Open water test, self propulsion test, bollard pull test.
3. Sea keeping test

Ocean Engineering Lab- Practicals

1. Calibration of wave probe
2. Determination of gauge factor for resistance strain gauge and PC based data acquisition system.
3. Calibration of linear variable differential transformer (LVDT)
4. Calibration of pressure transducers
5. Calibration of potentiometer displacement transducer (inclinometer)
6. Study of data acquisition system
7. Determination of elastic and stiffness of materials
8. Study of free – vibration characteristics of beams and estimation of material damping
9. Study of forced vibration characteristics of a multi – degree – of – freedom model
10. Estimation of forces on a vertical cylinder due to waves and current
11. Verification of dispersion relation of water waves and Determination of reflection coefficient for regular waves
12. Towing tank experiments – different aspects of ship resistance and propeller performance study

Total Hours: 40

Semester 8

15ETN067 Major Design Project-Phase-II 0 0 21 10

Course objective: The student will be able to carry out detailed design of the project in this phase and he will have to complete the project work by the end of the semester. He will give a seminar presentation on the calculations and drawings carried out to the guide so that he gains more confidence in the design aspects.

Total Hours: 40

Semester 8

15ETN068 Project Presentation and viva voce 0 0 4 2

Course Objective: The student will be presenting the design calculations and drawings carried out by him to the external examiner, thereby he is examined.

Total Hours: 40

SYLLABUS

DISCIPLINE SPECIFIC ELECTIVES

15ETN101 Ships Structural Dynamics 3 0 0 2

Course Objective: The student will become familiar with the dynamics of ship structure, basic terminology, periodic and harmonic motions, excitation sources and vibration responses, degrees of freedom, mathematical modeling, propeller excitation forces, etc.

UNIT I Dynamic System 9

Dynamic System Parameters; Bending and Shear Stiffness, added mass, Hydrodynamic and structural damping; coupled modes; experimental measurements and validation. Dynamic Systems, Excitation Sources and Vibration Response. General Introduction to Marine Dynamics: - Basic terminology, periodic and harmonic motions, Degrees of freedom, natural frequencies and modes of vibration, the phenomenon of resonance.

UNIT II Mathematical Modeling 9

Mathematical Modeling of Linear Systems:- Single-degree-of-freedom systems, free, damped, forced vibration, multi degree-of-freedom systems, bending stiffness, shear stiffness, rotary inertia, added mass and damping, appropriate methods to calculate added mass and damping.

UNIT III Excitation Sources 9

Excitation Sources: - Periodic, Machinery Excitation, Propeller Excitation, Steady state wave excitation, Impulsive excitation and slamming, Nature of slamming, slamming theories, Occurrence and severity of slamming, Preventative measures and criteria.

UNIT IV Vibration Response 9

Vibration Response – Ship Hull Vibrations: - Uniform beam, Euler, Bernoulli, Rayleigh and Timshenko beams, solutions for free and forced vibrations, Semi- Empirical and empirical methods, applications, Non uniform beam – Generalised Iterative method, applications, Non- Uniform beam – Prohl – Myklestad method, FEM, applications.

UNIT V Local Vibrations 9

Local Vibrations: Superstructure vibrations, Propeller Bossing, Shafting Vibration, Plate Vibration. Levels of Vibration: - Methods of approach, human reaction to vibration, guidelines for assessment, ISO recommendations. Design Guidelines: -Approaching vibration problems at the design stage and post-design corrective actions.

Total Hrs: 45

Text Books

1. R. Bhattacharyya, “Dynamics of Marine Vehicles”, John Wiley and Sons, 1978.
2. W.T. Thomson, “Vibration Theory and Applications”, George Allen and Unwin Ltd, 1976.

Reference Books

1. OM Faltinsen, “Sea loads on ships and offshore structures”, Cambridge University Press, 1990.
2. BR Clayton and RED Bishop, “Mechanics of Marine Vehicles”, Spon, 1981.
3. R.E.D. Bishop and W.G. Price, “A Unified Dynamics Analysis of hip Responses to Waves”, Transactions RINA. Vol. 119, 1977.

15ETN102 Ship Trials 3 0 0 2

Course Objective: The student will learn the various harbour and sea trials to be carried out for a vessel prior to commissioning and handing over to the owner. The trials will include harbor trials, sea trials, manoeuvring trials and speed trials which is a contractual obligation.

UNIT I Installation Inspection 9

Ships Machinery Installation including main engines, generators, pumps, compressors, educators, steering gear system, fire main system etc., Inspection by Surveyors, Complete Shaft alignment checks

UNIT II BasinTrials (Harbour Trials) 9

Start main engine in alongside condition, precautions to be taken, check marine engineering parameters start generators, monitoring performance, paralleling of generators, synchronizing of generators, load sharing, throw output. Start compressors and monitor performance. Fill up the Air reservoirs and note down the timing. Start sea water pumps, bilge educators and other auxiliary machinery.
Conduct steering / Rudder trials, Anchor trials in harbor.

UNIT III Sea Trials 9

Observe the performance of all auxiliary machineries at sea. Anchor Trials at sea by lowering and hoisting the anchor. Record the readings. Run main engine at various regimes and observe the performance.

UNIT IV Manoeuvring trials 9

Manoeuvring trials – zig zag manoeuvring, Spiral Manoevring, Pull Out Manoeuring, Crash Stopping, Turning circle trials etc.

UNIT V Contractual Obligation 9

Contractual Obligation. Speed trial , measured mile run.

Total Hrs: 45

Text Book

1. K J Rawson and E C Tupper , “Basic Ship Theory”, Longman, 1976
2. Lewis, E.U.; “Principles of Naval Architecture”, (2nd Rev.), SNAME, New Jersey, U.S.A.

Reference Books:

1. Robert Taggart, “Ship design and construction”, SNAME Publications

15ETN103 High performance marine vehicles 3 0 0 2

Course Objective: The student will get knowledge about the design aspects of non-conventional vessels, high speed crafts and special type of vessels. This will include mono hull, multi hulls, catamaran, trimaran, SWATH vessels, and other unconventional hulls, etc.

UNIT I Introduction 9

Introduction: Basic differences between conventional and high performance crafts. Special features. Types - Monohull: planning craft, hydrofoil craft, air cushion vehicles - Multihulls: Catamaran, trimaran, SWATH vessels, Unconventional hulls

UNIT II Hull forms 9

Hull forms - aero and hydrodynamic force - stability criteria, resistance of very slunder hulls, in particular importance of form factors, transom stern effects prediction of form factors for transom stern vessels, effect of water depth on HSE resistance,

UNIT III Resistance Prediction methods 9

Resistance prediction methods for HSE, regression, methods, potential flow methods, assumption and boundary conditions, This Ship theory, assumptions, approximation, key results, transom flow modeling, application to optimization, Introduction to Kelvin-Neumann approach, full non-linear potential flow methods, CFD, hybrid methods, Wave wake, background to problem, aspirations, for wave wake criteria, maximal way height criteria, wave energy and energy flux criteria, designing for minimal wave wake

UNIT IV Powering and Propulsion 9

powering and propulsion - seaworthiness - manoeuvring and control - structures and materials. Comparative performance and applications - maritime operational requirements. General features of marine water jets, water jet theory, mass flow rate, Gross thrust, net thrust, momentum drag,

UNIT V Water Jet and SWATH 9

Water jet propulsion, efficiency of water jet systems and losses, cavitation consideration, preliminary design of water jets, general design characteristics of SWATH and comparison to catamaran, Sea keeping design consideration. Dynamic stability of SWATH, control design, motion sickness and comfort factors, damage stability standards

Total: 45 hrs

Text books

1. Lewis, Edward V. (1990) Principles of Naval Architecture: Resistance, Propulsion and Vibration, vol 2, Society of Naval architects and Marine Engineers.
2. Rawson, KJ and Tupper EC (1976) Basic Ship Theory, Longman.

Reference Books

1. Muralidhar, K and Biswas, G (1996) Advanced Engineering Fluid Mechanics, Cambridge University Press, John Wiley.
2. Rama Durghaiah, D (2002) Fluid Mechanics and Machinery, New Age International Publishers.

15ETN104 Fishing Vessel Technology 3 0 0 2

Course Objective: The student will get knowledge about the various types of fishing vessels, fishing methods, fishing gears, preservation methods and economics of fishing operation. This will also include fishing vessel design, general arrangement, selection of main engine, trawling gear, etc.

UNIT I Introduction 9

Importance of fishing, Classification of fish for harvesting. Fishing methods- Purse seining, Drift netting, Gillnet fishing, Long line fishing. Pole and line fishing, Trawling, Harpooning, deep sea fishing.

Unit II Types of Trawling 9

Fishing Gear- Towed gear, Bottom trawling, side trawling, Towing arrangements, stern trawling operations and equipment, multiring trawling, Midwater trawling, Purse seining Types, Analysis of fishing nets.

Unit III Preservation of fish 9

Storing and preservation of fish on board a vessel, Fish hold arrangement. Insulation, icing and freezing. Refrigeration machinery.

Unit IV Fishing vessel design 9

Design of fishing vessels. Side trawlers, stern trawlers, purse seining. General arrangement, Layout and equipment on deck. Determination of main dimensions. Estimation of component weights. Development of lines. Estimation of resistance. Design of propellers for trawlers. Machinery- main and auxiliary, Electrical systems, structural arrangements. Materials for the construction of fishing vessels.

Unit V Economics of fishing vessels 9

Economics of fishing vessels. Estimation of initial and operation costs. The influences of size, speed, power, selling price, distance optimised fishing vessel design. Design and economics of simple low cost country fishing crafts.

Total: 45 hrs

Text Books

1. John Fyson; Design of Small Fishing Vessels, Fishing News Books, UK 1985
2. Rawson and Tupper, Basic ship theory, Prentice Hall.

Reference Book

1. Jan-Olaf Traung, Fishing Boats of the World, Fishing News Books, UK 1953

15ETN105 Ship Conversion Technology 3 0 0 2

Course Objective: The student will get in depth knowledge about conversion of one type of ship to another type including fixing of revised length, beam and depth, the cargo carrying capacity and redesignated functions. Checks on sea keeping qualities, selection of main engine, etc.

UNIT I Introduction 9

Basic ship parameters, existing ship stability condition, cross curves of stability, statical stability, and damage stability for the existing ships principle particulars.

UNIT II Fixation of revised length, beam and depth 9

Fixation of the revised length, beam and depth and the cargo capacity and redesignated functions, layout general arrangement including engine room lay out, deck plans, water tight bulk head arrangements etc.,.

UNIT III Stability calculations 9

For the revised requirement length, breadth, depth and workout revised functions of stability criteria, cross curves stability, statical stability curves, damage Stability Sea keeping maneuvering etc.

UNIT IV Hull design 9

Cross check the above calculations model testing. Ship yard operations, hull production, hull structural design, outfitting production (hull), outfitting production (machinery).

UNIT V Powering 9

Selection of main engine based on the revised powering calculations, revised shaft length, shaft bearings, Propeller design.

Total: 45 Hours

Text books

1. K J Rawson and E C Tupper “Basic Ship Theory”, Longman, 1976.
2. E.C. Tupper “Introduction to Naval Architecture” by, Butter worth Heinemann

Reference Books

1 Yasuhisa Okumoto, Yu Takeda, Masaki Mano, “Design of ship hull structures” Springer Publications, 2009

2. Robert Taggart, “Ship design and construction”, SNAME Publications

15ETN106 Subsea Engineering 3 0 0 2

Course Objective: The student will get knowledge about offshore production, gas reserves and fields, subsea production systems, risers FPSOs and FPVs, Pipelines and flowlines - Design and functions – Route survey, Autonomous Underwater Vehicles (AUVs) etc

Unit I Introduction to Subsea Production 9

Introduction to offshore production, Background to offshore production systems, Global oil and gas reserves and fields, Introduction to offshore exploration and drilling, Introduction to subsea engineering -Building blocks, Subsea Production Systems (SPS) and Umbilicals, Risers and Flowlines (URF) Other elements, Systems design. Types of subsea completions, Extensions to existing platforms, Tie-backs to existing production hosts.

Unit II Production systems 9

Production systems for floating hosts: Floating Production, Storage and Offloading systems (FPSOs) and Floating Production Vessels (FPVs), Well to beach developments (gas fields)**,** Flow assurance for subsea production systems – Hydraulics, Wax, Hydrates. Wellheads, Xmas Trees and Manifolds**-**Wellheads, Drilling subsea wells, Wellheads as part of drilling and production operations, Blowout preventers, Design and functions, Installation, Examples, Xmas trees, Types of trees, Dual bore vertical trees and spool/horizontal trees, Design and function, Suppliers, Installation, New developments (drill through and all electric trees) – Examples- Manifolds - Templates - Types of manifolds (wells clustered around manifold or template manifold) - Design and functions - Installation – Examples

Unit III Pipelines, Flowlines and Risers 9

Pipelines and flowlines - Design and functions - Route survey - Pipe selection of materials and coatings - Installation methods - Operations – Examples. Risers - Requirements and functions - Flexible dynamic risers - Design - Operation and use- Manufacture - Current developments - Hybrid riser towers - Steel catenary risers - Examples

UNIT IV Control Systems, Umbilicals and Equipment Costs 9

Subsea production control systems - Types - Electro-hydraulic multiplex control systems - Equipment and suppliers - Operations - Installations – Examples. Drilling control systems, Umbilicals - Functions - Design and manufacture - Installation – Examples. Costs of subsea equipment. Underwater Operations, Subsea Maintenance and New Technologies**.** Underwater engineering operations. Subsea deepwater installation activities. Inspection, maintenance and repair - Shallow water – diver operations - Deepwater diverless interventions - Remote Operated Vehicles (ROVs) - Autonomous Underwater Vehicles (AUVs) Decommissioning activities - Production hosts - Subsea equipment**.** New technologies - Subsea pumping - Subsea processing - Requirements - Systems and examples

UNIT V Subsea Reliability, Subsea Field Development Examples and Case Studies and Decommissioning Activities 9

Subsea completions - interfaces with other functions, Drilling and well completions, Production hosts - Government authorities. Examples of fields developed with subsea completions. Increased production to existing production host - North Sea fields. Tie back to production host - Gulf of Mexico fields - Norwegian fields. Subsea production to floating host - North Sea fields - Angolan fields - Australian fields - Brazilian fields. Gas fields – deepwater production to shallow water host - MCE (Gulf of Mexico) - Malampaya field (Philippines). Gas fields – well to beach - Orman Lange field (Norway) - West Delta Deep (Egypt)

Total: 45 hrs

Text Books:

1. Yong Bai, Qiang Bai, “Subsea engineering handbook”, 1st edition, gulf professional publishing, 2012
2. Andrew C Palmer and Roger A King, “Subsea pipeline engineering”, 2nd edition,Pennwell corporation, 2008

Reference Book:

1. Yong BaI, QiangBai, “Subsea pipelines and risers”, Elsevier,2005.

15ETN107 Computational Marine Hydrodynamics 3 0 0 2

Course Objective: The student will gain knowledge about theoretical computational and experimental methods, flow models, wave dominated flow, boundary element method, finite volume method, finite difference method and finite element method, etc.

UNIT I Introduction **9**

Introduction: Theoretical computational considerations and implementation; experimental validation. Hierarchical flow models: Potential flow, panel methods.

UNIT II Flow model **9**

Numerical solutions of boundary layer, incompressibility, vorticity and irrotationality, irrotational and incompressible boundary conditions. Potential flow models, linearity, example of flow around a circle, convection of fluid, wave-dominated flow, solution of linear convection.

UNIT III Boundary element method **9**

Relative merits and practical utilisation of boundary element method, finite volume method, finite difference method and finite element method.

UNIT IV Design and creation of grids **9**

Design and creation of grids: structured and unstructured mesh generation, mesh adaptation, numerical stability

UNIT V Capturing the essence of turbulence **9**

Capturing the essence of turbulence: modeling approaches, Reynolds stress in RANS-based models, large eddy simulation.

Total: 45 hrs

Text books

1. J.D.Anderson. CFD: The basics with applications, ed 6, 1995
2. D.C.Wilcox, Turbulence modeling for CFD.

Reference Books

1. H.K.Versteeg and W Malalasekera: An introduction to CFD – The Finite volume method.
2. P.Knupp and S.Steinberg. Fundamentals of grid generation, CRC press 1994.

15ETN108 Warship Design and Construction 3 0 0 2

Course Objective: The student will get fundamental knowledge about the type of warships, submarines, auxiallary vessels, type of warfare, weapon systems, sensors, NBCD warfare and design of the vessel as per the staff requirement, type of hull material and construction methods, etc.

UNIT I Introduction 9

Utility concept of War ships, Types of War ships, Types of war fare, systems and subsystems of War ship, Weapon detection and tracking systems in War ships, Nuclear and biological effects, NBCD war fare, citadel arrangement, counteracting, precautions in war ships, Tracking, reconnaissance.

UNIT II Mine warfare 9

Mines, Acoustics, resonance, magnetics and wave track, detection and destruction of mines, Types of mine sweepers ships, type of hull material and construction methods, degauging systems

UNIT III Design and construction of war ships 9

Design and construction of war ships, general arrangement of war ships, standards rules for classification, type of construction, midship section and structural arrangements, framing systems, material of construction , war ships performance criteria, Manoeuvring, capacity, shock, under water explosion and damage, subdivision, stability standards, electronic interactions, human factors, hiding features

UNIT IV Submarines 9

Type of submarines, general arrangements, maintain depth, manvoeuvring, snorting, type of propulsion, early warning and detection system for enemy submarines, air crafts and surface ships, nuclear submarines, construction methods and materials, stability standards

UNIT V World warship fleet 9

World warship navy fleet, special type of war ship, Exemplary analysis of War ships from world navy fleet, special types of war ships, types of weapon system

Total: 45 hrs

Text books

1. Principles of Naval Architecture Vol II & III, SNAME Publications
2. Rawson and Tupper, Basic ship theory, Prentice Hall

References books

1. Naval Forces publications
2. Jane's Fightings Ships, Prentice Hall
3. Jane's Naval Weapon System, Prentice Hall
4. Jane's Navy International
5. Journal of Naval Engineers

15ETN109 IMO regulations for ship design 3 0 0 2

Course Objective: The student will learn regulations such as IMO conversions, SOLAS, STCW, MARPOL, industry organizations, The Maritime Labour Convention, Ship classification society rules, Ship Safety and Operational survey, ship survey, etc.

Unit I IMO, ILO, international conventions and codes 9

An introduction to IMO and ILO and the development of international codes and conventions
The main IMO Conventions – SOLAS, STCW, MARPOL, The main IMO Codes - FTP Code, FSS Code, LSA Code, ISM Code, The Maritime Labour Convention, Flag State Manning Requirements, Classification society rules and the role of class, History of ship classification societies, IACS organisation and activities, The structure and rules of class, The multiple roles of classification societies

Unit II Industry organisations 9

ITF, ICS, ISF, BIMCO, OCIMF, Intercargo, Intermanger, Intertanko, TSCF, IPTA, SIGTTO, CLIA,
-Quality assurance, ISM and other quality control measures, Performance measures and non-conformities, Safety, Security, Health and Environment, Essential health and safety, ISPS, Environmental protection, Pollution, Carriage of goods by sea

UNIT III Ship Safety and Operational survey 9

Introduction to safety surveys, Life saving appliances, Fire protection, detection and extinction, Navigational aids and equipment, The role of classification societies with safety surveys, Statutory surveys, Classifications surveys Ship Life Cycle**,** Registration of ships, Flag State Requirements for Registration, tonnage and Marking, Ships Technical files, Records and surveys, Recycling, Environmental responsibility, Convention for the safe and environmentally Sound recycling of ships, Types of ship and cargoes, Safe loading and unloading, Carriage of dangerous goods at sea and the IMDG Code An Introduction to the Shipping Industry and the role of the Marine Surveyor – Marine surveying profession

UNIT IV Types of Surveys 9

Ship structures survey, ship engineering survey, ship electrical and electronics survey, safety and operational surveys, ship cargo survey, Draught Surveying, Surveying Dry Bulk Cargoes, Surveying Chemical Cargoes, Surveying Petroleum Products Crude and Refined Oils, Surveying the Carriage of Refrigerated Cargoes, Surveying Containers and Cargoes in Containers, Surveying Bulk Vegetable / Animal Oils & Fat Cargoes, Surveying General Cargo,Transportation of LNG & LPG Cargoes, Heavy Lift and project Cargoes survey, Surveying Engines & Marine Systems, Marine Coatings survey, Statutory Surveys, Safety and Operational Surveys, The International Safety Management Code, Flag and Port State Control Compliance Inspections, Report generation & Writing for Marine Surveys,

UNIT V Ship Survey 9

Types of ship structure, Main structural components, Use of Ships Drawings, Determination of extent of damage Structural strength, Calculations of steel weight and repair cost, Presentation of information/ Reporting, Surveying the Engines and Ship Systems, Slow speed engine, Medium speed engines, High speed engines, Ancillary systems, Steering gear, Hotel systems, Cargo gear and hatch covers, Distribution systems, Voltage and frequency, Cables, circuit breakers and associated equipment
, Switch boards and earth testing, Batteries and chargers, Diesel electric drives, Principle of operation of the electronic cell, Typical electronic circuits, Advantages of electronics, Typical control circuits, Alarm systems and engine controls, Lightning protection systems

Total: 45 hrs

Text Books

1. IMO Publications and documents
2. DnV Publications and documents

Reference Books

1. IACS Publications and documents
2. Norske Standards

15ETN110 Design of floating offshore structures 3 0 0 2

Course Objective: The student will get in depth knowledge about the floating offshore structures, semi-submersible, Heave RAO Calculation, functions and configurations of TLPs, design of Spar platform, Turret Design, design of drillships, Design and conversion of FPSO, FPS, etc.

Unit I Semi-Submersible

Design of semi-submersible: Functions and Configurations of Semi-submersibles, Sizing of Semi-submersibles, Initial Design Process, Heave RAO Calculation, Weight and Buoyancy Estimates, Semi-submersible Hull Structure, Design Example

Unit II Functions and Configurations of TLPs

Design of TLP: Functions and Configurations of TLPs, TLP Mechanics, Sizing of TLP, Weight Estimates of TLPs, Design Example

Unit III Design of Spar platform

Design of Spar platform: Spar Description, Spar Riser Systems, Spar Mooring, Spar Sizing, Drilling from a Spar, Spar Construction and Installation, Design Example

Unit IV Design and conversion of FPSO, FPS

Design and conversion of FPSO, FPS: FPSO Hull Design, Hull Structure, Deck Structure, Turret Design and Selection, Design Example

Unit V Design of Drillship

Design of Drillship: Design Considerations, Loads, Initial Scantling Evaluation, Total Strength Assessment, Topside and Hull Interface Structures, Fatigue Strength Assessment of Drillships, Material Selection, Design Example

Total Hours: 45

Text books

1. Subrata K Ckakrabarti, “Handbook of Offshore Engineering”, Vol 1, Elsevier Publishers, 1st edition, 2005.
2. Subrata K Ckakrabarti, “Handbook of Offshore Engineering”, Vol 2, Elsevier Publishers, 1st edition, 2005.
3. Jeom Kee Paik and Anil Kumar Thayamballi, Ship-Shaped Offshore Installations Design, Building, And Operation

Reference books:

1 Hiroshi Iwasaki, A preliminary design study of Tension Leg Platform, Massachusetts Institute of Technology, Department of Ocean Engineering, 1981

2 API,ABS,DNV codes

15ETN111 Marine Corrosion and Coating Engineering 3 0 0 2

Course Objective: The student will get in depth knowledge about the chemistry of corrosion, galvanic action, type of paints, varnishes, enamels, metallic coatings and protection, surface preparation, coating applications, methods of applications, manufacturers specification, etc.

Unit I Corrosion **9**

Galvanic cell, Formation theory- Differential aeration theory. Factors influencing rate of corrosion. Chemical and electrochemical corrosion, types of corrosion, general methods of prevention and control of corrosion, sacrificial anode method, paints, varnishes and enamels, metallic coatings, hot dipping, galvanizing, electroplating.

Unit II Protective Coatings Application **9**

Paints-definition- components of paints and their functions- Special paints- Luminescent, heat resistant, fire retardant, Anti-fouling paints Health & Safety, Access Systems, Surface Preparation, Paint Types, Paint application and various methods, Paint Manufactures specification, Coating Inspection and Coating Inspection Equipment

Unit III Abrasive Blast Cleaning **9**

Abrasive Blast Cleaning Introduction, Health and Safety, Blast Media, Abrasive Blast Cleaning Standards & Quality Control, Abrasive Blast Cleaner Operational procedures, Process Control

Unit IV Paint Spraying& inspection **9**

Introduction, Health and Safety, Paint Materials, Airless Spray Equipment, Conventional Air Spray Equipment, coating failures, metallic coating, design and construction , concrete, coating surveys, paint manufacture specialist coating, ISO and other international standards, quality management , paint testing, paint thickness measurement(dry and wet) , soluble slats, fire protection

Unit V IMO& NACE Guidelines **9**

Marine PSPC, External corrosion and Coating Surveys, Cathodic Protection, Metallic Coatings, Specialist Coatings, Pipeline and facility external corrosion control, Facilities and pipelines cathodic protection design, Pipeline Coatings, and pipeline coating inspection, Pipeline HVAC induced interference, Coating Failures Degradation mechanisms and their control, Paint Repair Technologies, Estimation of paints qty.

Total: 45 hrs

Text Books

1. EC Tupper, Intoduction to Naval Architecture, Betterworth- Heinemann, UK
2. Lloyds painting manuals
3. Paint manufactures recommendations

Reference Books

1. Painting Schemes of Indian coast guard, shipping corporation of India and Indian navy.
2. ISO and other international standards on painting.
3. Onboard maintenance painting guide, International paints

15ETN112 Marine Refrigeration and Air-conditioning 3 0 0 2

Course Objective: The student will get knowledge about the refrigeration and air conditioning systems onboard the ship, compression and evaporator systems, Psychometric charts, Marine Refrigerating Plants**,** Refrigerated cargo vessel and refrigerated containers, etc.

UNIT I Basic Refrigeration and Air conditioning 9

Reversed carnot cycle- vapour compression cycle –Refrigerating effect-co-efficient of performance – cooling capacity-refrigerants and secondary refrigerant used in marine practice and their justification-rating of refrigeration plant –methods for improving C.O.P –use of vapour tables –applied problems .

UNIT II Marine Refrigerating Plants 9

Typical marine refrigerating plants with multiple compression and evaporator system –heat pump cycles – refrigeration in liquefied gas carriers.

UNIT III Air conditioning 9

Psychometric charts-various processes-comfort and industrial A/C –Effective temperature and comfort-chart-unitary and central A/C system Marine Air Conditioning, Principles of air conditioning – psychometric properties of air – comfort condition – control of humidity – airflow and A.C.Capacity – Calculation for ships plants. Design and construction details of various equipment for air conditioning used in marine practice and their justification and humidity.

Unit IV Marine refrigeration 9

Design and constructional details of various equipment used for refrigeration in marine practice, operation and maintenance, Refrigeration and A/C components. Operation, maintenance and trouble shooting of compressors and its unloader lubrication system for different compressors –properties of lubrication for refer compressor . Evaporators- condensers –expansion devices- thermostatic switches- solenoid valves-low pressure and high pressure but Out switches. Gas leak detection- rectification and charging of gas.

Unit V Refrigerated cargo vessels and refrigerated containers 9

Refrigerated cargo vessel- hold arrangements-air ventilation and circulation systems-insulation-precooling, classification society requirement, survey and certification guidelines, refrigerated containers-guide lines, duties responsibility of marine engineers- ventilation system- controlled atmosphere- carriage of fruit cargoes.

Total: 45 hrs

Text Books:

1. Arora C.P. " Refrigeration & Air Conditioning", 1st adition, Sri Eswar enterprises, Chennai, 1993.
2. Stoecker, Willbert.F Jones, Jerold.W., " Refrigeration and air conditioning", 2nd edition, Tata McGraw-Hill, Delhi 1985

Reference Books:

1. D.A.taylor, " Introduction to marine Engineering", 2nd Edition, Butter Worth, London, 1993.
2. J.R.Stott, "Refrigerating Machinery and Air Conditioning Plant", 1ST Edition, The Institute of marine engineers, London, 1974, Reprint 1998.

SYLLABUS

GENERIC ELECTIVES

15ETN151 Engineering Economics and Management 3 0 0 2

Course Objective: The student will learn economic science, consumption, utility, business organization, partnership, laws of production, personnel management, competition advertisement and product differentiation, management control: power, authority responsibility and accountability etc.

UNIT I Introduction 9

Definition – nature and scope of economics science – economics relation between economics decision and technical decision – economic efficiency and technical. Consumption – utility – diminishing marginal utility – indifferent map analysis.

UNIT II Four factors of production 9

Production: Four factors of production and their peculiarities law of production – increasing – diminishing and constant return forms of business organization proprietorship – partnership joint stock company – division of labour- large scale production price mechanism. Demand and supply-elasticity of demand – different market structures- competition- monopoly- monopolist competition advertisement and product differentiation. Distribution: Marginal productivity theory of distribution – modem theory of distribution, gross and net profit-theories of profit rich theory- Ucerlamy theory – Innovative theory profit.

UNIT III Systems concept 9

Systems concept, management control: power, authority responsibility and accountability; managerial functions conventional structures and relationships, hierarchy; the hierarchy of objectives; management by objectives; different schools of thought in management.

UNIT IV Personnel Management 9

Personnel Management Recruitment, employment tests labour turnover, operator training; suggestion systems; Industry safety. Wages and Incentives; feature of wages; time and piece rate different incentive plans; profit sharing; job evaluation and ranking; factors of comparison and point rating.

UNIT V Behavioural science and psychology 9

Scope and methods of behavioural science and psychology. Basic psychological processes perception, motivation, learning and retention. Psychology of individual differences – the concept of personality, measurement and assessment of personality. S-O-B model; A conceptual scheme for the understanding of work performance and behaviour of individuals and groups in the organization context. Marketing Management: Concept of marketing in sales approach product principles of accounting and finance statements. Long Term Financing: Equity, preference and debenture capitals term longs: dividends and share valuation: legal aspects of dividends; short term financing; working capital; management of receivable and inventories.

Total Hours: 45

Text Books:

1. R.R. Borthwal “Industrial Economics-An introductory text”, New age, International publication, 2nd edition.
2. Paul A. Samuel, “Economics – An Introductory analysis” Mc graw hill, 1961.
3. Alfred W. Stonier and Double C Hagum, “ A Text Book of Economics Theory”, 5th edition, Pearson publishing.

Reference Books:

1. Stephen P. Robbins; “Organizational Behaviour – Concepts Controversies Application,” Prentice – Hall Pvt.’ New Delhi, 1996

2. Fred Luthans, " Organizational Behaviour", Mcgraw – Hill Inc,1995

15ETN152 Production and Project Management 3 0 0 2

Course Objective: The student will learn production design, application of the principles of design for production in shipbuilding – joining of parts, ship building process planning, scheduling, process analysis and flow process charts, controlling the ship building process to meet the delivery date of the ship.

UNIT 1 Production design 9

Production design – application of the principles of design for production in shipbuilding – joining of parts; relations between structural design and prefabrication, simplifications in structural design (design for welding), quality control.

UNIT II Problems of accuracy 9

Problems of accuracy - tolerances, standards, measuring techniques (theodolite, laser, etc); quality control. Process planning in shipbuilding :-Planning for operations - interconnection between production design and process planning, production and process analysis, assembly charts, operation process charts, flow process charts; Process selection.

UNIT III Planning, scheduling and controlling 9

Application of models for process planning, scheduling and control - Gantt charts, CPM & PERT, transportation models etc.; Special aspects of application of these in shipbuilding process. Procedure control and systems control of production, time and motion study, material control and plant safety, industrial relations, personal management, training human relations, labour organization, dry docking and maintenance of ships.

UNIT IV Capacity planning 9

Capacity planning - estimation of future capacity of shipyard methods, strategies for modifying capacity, models for capacity planning under the special conditions of shipbuilding.

UNIT V Production standards 9

Production standards - production standards in several parts of the ship production. Process. Work measurement systems, methods of man - hour determination, use of computers, correlation between size of series and needed man – hours. Systems of maintenance and quality control. Shell plate development & Nesting, Application of Gantt-charts and network techniques. Design of a panel -line and capacity calculation, design of a special part of a shipyard layout (e.g. steel stockyard, dry-dock)

Total Hours: 45

Text Books

1. Taggart; ship design and construction, SNAME chapter 15, 1980
2. Storch R. Lee, Hammon C.P. & Bunch H.M..; Ship Production, Cornell Maritime Press, Maryland, USA, 1988
3. Eyres D.J.; Ship Construction William Heinemann Ltd, London, 1982

Reference Books

1. Dormidontov V. K. & et.al; Shipbuilding Technology, Mir publishers, Moscow.
2. Buffa, Modern production operations management, 6th edition, Wiley 1980

15ETN153 Quality control and Quality Assurance 3 0 0 2

Course Objective: The student will understand basic definition of quality, Quality history, Major contributors to quality, quality control, quality assurance, quality management, Cost measurement ,Utilizing Quality Costs for Decision-Making, quality planning and development, etc.

Unit I Introduction **9**

Definitions of quality ,Quality basics and history, Major contributors to quality, Approaches to managing quality, Quality control, quality assurance, quality management.

Unit II Total quality management **9**

Strategic Quality Management : STQM, Dimensions, measures, and metrics, Garvin's approach to operationalizing quality dimensions, quality planning, key elements of quality planning, quality costs analysis, Cost Measurement ,Utilizing Quality Costs for Decision-Making

Unit III Designing quality **9**

Designing Quality Into Products and Services :Seven management tools Quality function deployment (QFD) Design for six sigma (DFSS) Robustness, Reliability, Risk assessment (FMEA and FTA)

Unit IV Customer requirement **9**

Indentification of customer requirements, documentation requirements and control, quality planning, design and development, skilled labour, competence/ training and awareness, quality of purchased products, verification purchased products,

Unit V Quality inspection and testing **9**

Identification and tracability, Non-destructive testing, operation control.Dimensions of quality, inspection / testing, measurement and monitoring of products, dock trials, sea trials

Total Hours: 45

Text books

1. Frank M Eyne “Quality planning and analysis”, McGraw-Hill, 2001
2. ISO 9001:2008, QMS manuals

Reference Books

1. Madhav N. Sinha, Walter W. O. Willborn, “The management of quality assurance”,Wiley, 1985
2. Storch, Rl, Hammon, Cp, Bunch, Hm & Moore, R; Ship Production (2nd edition) cornell maritime Press, 1995, SNAME Publications

15ETN154 Health Safety and Environment Management 3 0 0 2

Course Objective: The student will learn about safety, health and environmental management, basic definitions, safety organizations, hazard and hazard control, safety in design and operation, Hazard assessment. Fatality risk assessment , fire prevention, etc.

Unit I Introduction 9

Introduction to safety, health and environmental management. Basic terms and their definitions of safety in petroleum and offshore industry. Importance of safety in petroleum and offshore industry. Rules on safety regulations.

Unit II Safety assurance and assessment 9

Safety assurance and assessment. Safety in design and operation. Organizing for safety. Hazard classification and assessment. Hazard evaluation and hazard control

Unit III Environmental issues and Management 9

Environmental issues and Management. Atmospheric pollution. Flaring and fugitive release. Water pollution- drilling waste, produced water, oil spills, cooling water, processed water- soil waste rock cutting, oil sludge, drilling solid waste, production waste. Environmental monitoring. Environmental impact and decommissioning.

Unit IV Risk assessment 9

Environmental management. Accidents modeling- release modeling. Fire and explosion modeling. Toxic release and dispersion modeling. Accident investigation and reporting. Concepts of HAZOP and PHA. Risk assessment and management. Risk picture- definition and characteristics. Risk acceptance criteria. Quantified risk assessment. Hazard assessment. Fatality risk assessment. Marine systems risk modeling. Risk management.

Unit V Safety measures 9

Safety measures in design and process operations- inerting, explosion, fire prevention, sprinkler systems. Principles and methods and concept optimization for offshore petroleum industry. Analysis of case studies from offshore and petroleum industry

Total hours: 45

Text Books

1. Skelton, B. (1997). *Process safety analysis,* Gulf Publishing Company, Houston, 210pp.
2. Jan Erik Vinnem (2007). *Offshore Risk Assessment: Principles, Modeling and Applications of QRA studies.* Springer, 577pp.
3. Terje Aven and Jan Erik Vinnem. (2007). *Risk Management with applications from Offshore Petroleum Industry*. Springer, 200pp.

Reference Books

1. Jorg Schneider. (1997). *Introduction to Safety and Reliability of Structures.* Structural Engineering Documents Vol. 5, International Association for Bridge and Structural Engineering (IABSE), 138pp.

2. Lees, F.P. (1996). *Loss Prevention in Process Industries: Hazard identification, Assessment and Control,* Vol. 1-3, Butterwort-Heinemann, Oxford, 1245pp.
3. *Patin, Stanislav. (1999).* Environmental Impact of the Offshore Oil and Gas Industry. *Eco Monitor Publishing, USA, 425pp.*
4. *William J. Cairns (Ed), 1992.* North Sea Oil and the Environment: Development Oil and Gas Resources, Environmental Impacts and Responses*, International Council of Oil and the Environment*

15ETN155 Marine Boilers and Steam Engineering 3 0 0 2

Course Objective: The student will understand type of boilers, fuel oil system, operation and maintenance, type of turbines, General layout, and installation of geared turbines, flexible coupling, layout of plans, turbine installation including auxillaries, etc.

UNIT I General considerations in design of boilers 9

Type of marine boilers, comparison of smoke tube and water lube and water tube boilers, furnace, destructive and non destructive on plates, rivets, welded seams, classifications societies requirements for boilers construction. Smoke tube boilers: Various types in marine use, principal dimension and staying of flat surface of multi tubular cylinder boilers, vertical auxiliary boilers. WATER TUBE BOILERS
General description with sketches of principal types of boilers in marine use,furnace,super heater, economizer, air preheated and steam preheated circulation and use of un heated down comers in highly rated boilers ,superheat temperature control,at temperature and de super heaters , double evaporation boiler.

UNIT II Fuel Oil System 9

Fuel systems including pumps, heaters, burners etc, and types of burners. WASTE HEAT BOILERS
Waste heat recovery calculations, Lamont exhaust boiler, Cochran exhaust gas and composite boiler etc..Forced water circulation boilers and associated systems. MARINE BOILERS AND STEAM ENGINEERINGS Boiler Mountings: Classification requirements, different mountings, safety valves-improved high lift, full lift and full bore type, gauge glass-ordinary plate type and remote indicator, automatic feed regulator, high and low water level alarms, main steam stop valves, retractable type soot blower etc.

UNIT III Operation, care and maintenance 9

Pre-commissioning procedures, hydraulic tests, steam raising and operation procedures, action in the event of shortage of water, blowing down of boiler, laying up a boiler, general maintenance, inspection and survey of boilers, plugging of tubes and their renewal. Boiler water treatment: Importance of boiler water treatment, effect of boiler water on boiler. Marine steam turbines: Development in steam engines, reciprocating engines to pressure steam to pressure steam turbines to modern high superheat, reheat and regenerative plants, general principals of construction and design, simple,impulse,pressure compounded impulses, pressure velocity compounded impulse, parson's axial flow reaction turbine, double flow turbine, radial flow reaction turbine, double casing turbine

UNIT IV Layout of plans 9

General layout and description of a modern geared steam turbine installation including auxiliaries in marine use location of gears, flexible coupling and coupling blocks steam exhaust and drain line system gland steam systems Selection of materials: Materials used for various compounds Constructional details: Types of blades and methods of fixing solid built up and drum rotor for impulse and reaction turbine casing for H.P and L.P impulse and reaction turbines. Diaphragms, nozzles and glands, carbon glands and labyrinth packing glands, bearing and gears. All addendum gearing, epicyclical gearing, articulated type double reduction gearing for marine use.

UNIT V Lubrication of Turbines 9

Suitable oils and their properties, film lubrication, forced lubrication lubrication of main bearings and gears, types of all oil jets, emergency lubrication arrangements Operation and maintenance: Warming up procedure of main propulsion turbines, ahead and astern running. Control of power and speed of propulsion. Throttle valve and nozzle control governing: self-closing emergency

Total Hours: 45

Text Books

1. Marine Boilers 3rd edition-GTH Flanagan
2. Marine Steam Boilers-JH Milton

Reference books

1. Marine Machinery-WJ Smith
2. Eng Knowledge-Vol.8-Reeds
3. Ship's auxiliary machine manuals

15ETN156 Ship Construction contracts and management 3 0 0 2

Course Objective: The student will understand the basic definition of ship construction contracts, interpretation, assignments, responsibilities, schedule of key dates, Liquidated Damages, Variations in respect of delay and/or additional cost, Disputed Variations, etc.

UNIT I Introduction **9**

General Conditions, Definitions, interpretation, company and Contractor Representatives- General, Company, Contractor Representative, Contractor's And Company's General Obligations, Responsibility for Company-Provided Items, Contractor to Inform Itself, Contractor to Inform Company/Company to Inform Contractor

UNIT II Assignment and Subcontracting **9**

Assignment, Subcontracting, Contractor Personnel, Access to the Worksite, Programme, Technical Information, Inspection and Testing, Variations-Right of the company to issue instructions, variations generally, contractor's right to request a variation, contractor's estimates, adjustments to contract price and schedule of key dates, variations in respect of delay and/or additional cost, disputed variations

Unit III Force Majeure clause **9**

Force Majeure, Suspension, Terms of Payment, Taxes and Tax Exemption Certificates, Ownership, Patents and Other Proprietary Rights, Laws and Regulations, Indemnities, Insurances, Care of the Permanent Work, Consequential Loss, Confidentiality, Customs Procedures, Completion, Defects Correction, Termination, Audit and Storage of Documents, Business Ethics

UNIT IV General Legal Provisions 9

Waiver, Retention of rights, contractor's affiliates, independence of the proper law and language, notices, status of the company, entire agreement, mitigation of loss, invalidity and severability

Unit V Liquidated Damages 9

Limitations of Liability, Limitation of Liability, Limitation Period, Extent of exclusion or limitation of liability, Precedence, Resolution of Disputes, Contracts (Rights of Third Parties) Act, Health, Safety and Environment, Form of Agreement

Total Hours: 45

Text Books:

1. IMCA Marine Construction contracts by IMCA council
2. Elwood S Buffa; Modern Production/Operations management, Wiley Eastern Ltd.
3. Richard J. Hopeman, Production-Concepts, Analysis, Control 3rd Edition, Charles E Merril Publishing Co.

Reference Books:

1. Arthur C Laufer, operations management, south-western publishing Co.
2. Khanna, OP, Industrial Engineering and Management, Dhanpet Rai Publication
3. Richard 1 Levin et al, Production I Operations Management: Contemporary

15ETN157 Shipyard Organization and Management 3 0 0 2

Course Objective: The student will become familiar with the shipyard organizations, shipyard locations, work process planning, production design, personal management, industrial relations, labor organizations, Production Inventory System, etc.

UNIT I Shipyard Location 9

Shipyard Location Organization, Chart, various work centre's workshops work. Flow from one centre to another, functions of each work centre, sequence of work completion.

UNIT II Scheduling of work 9

Scheduling of work process planning, production design, process planning, process analysis, scheduling and control, GANTT charts, CPM & PERT control of production time and motion study, material control, plant safety, delay in job completion, time and cost, over-run.

UNIT III Industrial relations 9

Industrial relations, personal management, training, human relations, labour organization. Structural Design and Prefabrication, Accuracy - Tolerancess, Standards, measuring techniques (theodolite, Laser etc) Quality Control.

UNIT IV Production standards 9

Production standards for several parts of ship production work measurement systems, methods of man – hours determination, systems of maintenance and quality control.

UNIT V Production Inventory System 9

Production Inventory System – Functions of inventory, inventory costs, models, production planning & control, pre-production activities, planning and scheduling.

Total: 45 hrs

Text books

1. Taggart; "Ship Design and Construction", SNAME Publications.
2. Khanna O.P, Industrial Engineering and Management, Dhaupat Raj Publication
3. Eyres D.J. Ship construction, William Heinemann Ltd. London, 1982.

Reference Books

1. Stephen P.Robbins; Organizational Behaviour – concepts controversies applications,Prentice Hall Pvt Ltd, New Delhi 1996.
2. Storch R. Lee, Hyammon C.P & Burch H.M; Ship Production, Cormell Maritime Prass, Maryland, USA, 1988.

SYLLABUS

ABILITY ENHANCEMENT COMPULSORY COURSE

15ETN201 English for Engineers-I (AECC-I) 2 1 0 3

Course Objective: To develop students' aural competency and language fluency and to develop students' reading skills and to enable them to skim the text for the main idea, to scan the text for the specific information, to interpret the text and to deduce the meaning from the context. To train students in organized academic and professional writing. To help the students' achieve proficiency in the effective use of language in various career - related situations.

UNIT I Skill Development **9**

Listening Skills, Speaking Skills, Communication Skills, Telephone Skills.

UNIT II WRITING SKILLS **9**

Paragraph Writing, Description &Narration, Letter Writing, Note Making

UNIT III PRECISE WRITING & ABSTRACTING **9**

Precise &Abstract writing, Report Writing, Remedial Grammar

UNIT IV JOB-RELATED COMMUNICATION **9**

Preparation of Curriculum Vitae, Preparation for interview, preparation for group discussion

UNIT V READING HABITS **9**

Developing reading habits, Vocabulary, Reading Comprehension

Total hours: 45

TEXT BOOKS

1. S P DHanavel, English and communication skills for students and engineering, Orient Black swan

REFERENCE BOOKS

1. Cambridge Advanced Learner's Dictionary - Paperback Edition With CD
2. Wrenn and Martin, English grammar

15ETN202 Environmental Science (AECC-II) 3 0 0 2

Course Objective: To develop the students' understanding in environmental related issues such as environmental, air, water and soil pollution**,** need for public awareness**,** natural resources and biodiversity**,** Renewable and non-renewable resources, threats to biodiversity, etc.

UNIT I Environmental awareness 9

Environmental awareness: Multidisciplinary nature of environmental Science, Definition, Scope, Importance and need for public awareness. Ecology and Environment: Concept of an ecosystem, structure and function of an ecosystem, producer consumer and decomposer, energy and nutrient flow biogeochemical cycles, food chain, food web, ecological pyramid.

UNIT II Environmental Pollution 9

Environmental Pollution: Segments of environment, sources, pathways and face of environmental pollutants, causes of environmental pollution - physical, chemical and biological transformation of pollutants, population explosion, environment and human health, human rights, value education, women and child welfare.

UNIT III Air Pollution 9

Air Pollution: Various segments of atmosphere and their significance, classification of air pollutants, toxic effects, sampling and analysis, stationary and mobile emission, sources and their control, photochemical smog, sulphurous smog, green house effect, global warming, ozone depletion, Air (prevention and control of pollution) Act.

UNIT IV Water pollution 9

Water pollution: Water resources, sources of water pollution, various pollutants, their toxic effect, potability of water, municipal water supply, disinfection, characteristics of waste, primary and secondary waste water treatment, BOD and COD measurement and their significance, rain water harvesting, water shed management, Water (pollution and control) Act.

UNIT V Natural Resources and Biodiversity 9

Natural Resources and Biodiversity: Renewable and renewable resources, Forest resources, consequences of deforestation, floods and draughts, equitable use of resources for sustainable development. Dams benefits and problems. Biodiversity: Ecosytsem diversity, threats to biodiversity, conservation of biodiversity. A brief introduction to Noise Pollution, Soil Pollution, solid Waste Management.

Total hours: 45

Text Books

1. Dr. V. Balasubramaniam, Dr. Sreedevi, Dr. G. Ramachandran, Environmental Science, CARS Publishers, West mambalam, Chennai-33

Reference Books

1. De AK. Environmental Chemistry, Wiley Eastern Ltd.
2. Miller T.G. Environmental Science, Wadsworth Publishing Co. (TE)
3. Sharma B.K.2001, Environmental Chemistry, Gael Publishing House, Meerut Odem,
4. E.P.1971 Fundamentals of Ecology W.B. Saunders Co. U.S.A

15ETN203 English for Engineers-II (AECC-III) 2 0 0 3

Course Objective: To develop students' aural competency and language fluency and to improve grammar, accent, pronunciation, their reading, writing and listening skills, sentence formation, conversation skills, verbal communication skills, importance of international standard accent, etc.

UNIT I Grammar **9**

Different Types of Sentences, Transformation of Sentences, Structure of Sentences Concord, Question Tags.

UNIT II Accent & Pronunciation **9**

What is an Accent? Indian Accent, MTI (Mother Tongue Influence), GME (General American English) & RP (Received Pronunciation UK). The Importance International Standard Accent – IPA (International Phonetic Association).The Importance of Consonant Sounds in Pronunciation, Intonation & Word Stress, Often Mispronounced words, DO's & Don'ts in English Conversation, Pronunciation of ''The" Before Vowels & Consonants, Pronunciation of ''R'' Before Vowels & Consonants, Use of Articles Before Vowels and Consonants, Verbal & Non – verbal Communication Developing, Communication Skills.

UNIT III Soft Skills **9**

Presentation Skills, Group Discussion, Extempore Speech, Interview, Power Point Presentation & Techniques – Dos and Don'ts.

UNIT IV Writing Skills **9**

Types of Reports & Report Writing

UNIT V Reading & Listening Skills **9**

Reading & Listening Techniques

Total hours: 45

Text Books

1. Cambridge Advanced Learner's Dictionary - Paperback Edition With CD

Reference Books

1. Strengthen Your Writing - V R Narayanswami; Orient Longman Private Ltd.
2. A Course in Listening and Speaking Book II - B Sasikumar,

SYLLABUS

SKILL ENHANCEMENT COURSE

15ETN251 Personality Development (SEC-I) 1 0 0 1

Course Objective: To develop students skill in communication, listening, presentation, public speaking , body language, personal etiquttes, behavior with colleagues and subordinates, group discussions, leadership qualities, etc.,

Development of Soft Skills such as:

- Communication skill -
- Listening,
- Presentation,
- Public Speaking etc

Total hours: 40

15ETN252 National Services Scheme (SEC-II) 0 0 1 1

Unit – 01: Citizenship (7)

a) Basic Features of Constitution of India (2)
b) Fundamental Rights and Duties (2)
c) Human Rights (1)
d) Consumer awareness and legal rights of the consumer (1)
e) RTI (1)

Unit – 02: Family and Society (6)

a) Concept of family, community, (PRIs and other community-based organizations) and society (2)
b) Growing up in the family – dynamics and impact (1)
c) Human values (1)
d) Gender justice (2)

Unit – 03: Health, Hygiene & Sanitation (7)

a) Definition, needs and scope of health education (1)
b) Food and Nutrition (1)
c) Safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyam) (2)
d) National Health Programme (2)
e) Reproductive health (1)

Unit – 04: Youth Health (6)

a) Healthy Lifestyles (1)
b) HIV AIDS, Drugs and Substance abuse (2)
c) Home Nursing (1)
d) First Aid (2)

Unit – 05: Youth and Yoga (9)

a) History, philosophy and concept of Yoga (2)
b) Myths and misconceptions about yoga (1)
c) Different Yoga traditions and their impacts (2)
d) Yoga and Preventive, promotive, and curative method (2)
e) Yoga as a tool for healthy lifestyle (2)

Project Work/Practical

Preparation of research project report **40 Marks**

15ETN253 Soft Skill (SEC-III) 0 0 1 1

Course Objective: To understand and develop student's ability on aspects such as logical thinking, reasoning, problem solving aptitude and adaptability, willingness to undertake challenging tasks, etc.

Development of the following Soft Skills-

1. Logical Thinking
2. Reasoning
3. Problem Solving Aptitude
4. Adaptability

Total hours: 40