SEMESTER: I

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)				
Course Code	Course Name	L	T	P	C
UBLEC01	Technical English - I	2	0	0	2
Year and Semester	I Year & I Semester	Contact Hours Per Week			
Prerequisite course	Nil	2 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	√				
	Basic Science	Engineering Science	Open Elective	Mandatory	

Course Objectives

1. To make the students learn to speak grammatically correct English. Guiding and supporting their skill development –Listening, speaking, reading and writing in English.
2. Making them realize the importance of English as Global language and its importance in today's scenario.

Course Outcomes

After successful completion of Course, the students will be able to

1. Outline the importance of technical English.
2. Illustrate technical and general vocabulary.
3. Distinguish different tenses and identification of common errors
4. Infer the skill for writing formal and informal letters
5. Develop good listening and speaking skills
6. Apply the skills to speak and write English grammatically

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	2	3	2	-	3	3	-	3	-	-	-
CO2	-	-	-	-	-	3	2	-	2	2	-	3	-	-	-
CO3	-	-	-	-	2	2	2	-	2	2	-	2	-	-	-
CO4	-	-	-	-	2	2	2	-	3	3	-	3	-	-	-
CO5	-	-	-	-	2	2	2	-	3	3	-	3	-	-	-
CO6	-	-	-	-	2	3	3	-	3	3	-	3	-	-	-
AVERAGE	-	-	-	-	2	2.5	2.2	-	2.7	2.7	-	3	-	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT 1: COMMUNICATION SKILL & READING SKILL **6 Hrs**

Importance of Technical Communication-Topic sentence and its Role-Reading and Interpretations-Critical Reading -Creative and Critical Thinking-Note Making -Transfer of Information-Visual Aids-Graphics-Lab.

UNIT II: FOCUS ON LANGUAGE – VOCABULARY **6 Hrs**

General Vocabulary-Dictionary-Word Formation: Prefix and Suffix-Synonyms and antonyms- Idioms and Phrases-Homophones-Technical Vocabulary-Words commonly misspell –Lab-Test.

UNIT III: ENGLISH GRAMMAR **6 Hrs**

Parts of Speech-Subject Verb Agreement-Tenses, Articles, Prepositions-Common errors in English-Lab-Test.

UNIT IV: WRITING SKILL **6 Hrs**

Descriptive Writing –Paragraph-Technical descriptions-Essays-Letter Writing – Formal and Informal-Business Letters-Job Application Letter-Types of reports-Instructions and Checklists- Lab-Test.

UNIT V: LISTENING AND SPEAKING **6 Hrs**

Types of Listening -Listening and note taking-Pronunciations-Stress and Intonation- Conversation technique-Dialogue Writing -Professional Communication-Interview-Group Discussion –Power point Presentation Lab.

TOTAL: 30 Hours

TEXT BOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Essential Grammar in use- Raymond Murphy, Cambridge, 2007.
2. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
3. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
4. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
5. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
6. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)					
Course Code	Course Name		L	T	P	C
UBMTC01	Engineering Mathematics-I		3	1	0	4
Year and Semester	I Year & I Semester		Contact Hours Per Week			
Prerequisite course	Nil		4 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
	√					

Course Objectives	1. To know the application of analytical geometry and understanding shapes of three dimensions. 2. To understand the techniques of differentiating a function. 3. To acquaint the student with function of several variables. 4. To introduce the concepts and methods to solve the integrals. 5. To understand the application of integrals.
Course Outcomes	After successful completion of Course, the students will be able to 1. Solve the problems using three-dimensional analytical geometry. 2. Apply the theorems and formulae for solving problems in differential calculus. 3. Classify the functions of several variables 4. Apply integral calculus on engineering problems. 5. Use multiple integrals to solve problems 6. Apply the concepts of Calculus and analytical geometry for engineering applications

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	2	2
CO5	2	2	2	2	2	-	-	-	-	-	-	1	-	3	3
CO6	3	3	3	2	2	-	-	-	-	-	-	2	3	3	3
AVERAGE	2.7	2.7	2.7	2	2	-	-	-	-	-	-	1.8	2.3	2.4	2.4
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: THREE DIMENSIONAL ANALYTICAL GEOMETRY **12 Hrs**

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT- II:- DIFFERENTIAL CALCULUS **12 Hrs**

Differentiation of algebraic – circular - exponential and logarithmic functions of products and quotient – Functions of a function and simple implicit functions – Successive differentiation- introduction and notation – nth order derivatives of standard functions – nth order derivatives using trigonometric identities and standard functions and partial fractions – Leibnitz theorem – Maclaurin‘s Theorem and standard expansions – Taylor‘s theorem – Indeterminate forms and L‘Hospital‘s rule.

UNIT- III:- FUNCTIONS OF SEVERALVARIABLES 12 Hrs

Limits and continuity-Partial derivatives – definition-geometrical interpretation and rules of partial differentiation – Higher order partial derivatives – Homogeneous functions – Euler‘s theorem for homogenous functions – Total derivatives and chain rules – Differentiation of implicit functions and composite functions – Maxima and Minima– Method of Lagrangian multipliers.

UNIT- IV:- INTEGRAL CALCULUS 12 Hrs

Integration by trigonometric substitution – The definite integral as the limit of a sum- Bernoulli's rule – Reduction formulae – Properties of definite integrals – beta and gamma Functions and problems – Work done by variable forces – mean values – Root mean square values of in sin x and Cos nx.

UNIT –V:- MULTIPLE INTEGRALS 12 Hrs

Double and triple integrals – Cartesian coordinates – Region of integration and change of order of integration – Spherical polar and cylindrical coordinates Theorems of parallel and perpendicular axes. Applications – Area – Volume - Mass of wire - lamina and solid - Centre of Gravity of wire – lamina and solid – Moment of Inertia using multiple integrals.

TOTAL : 60 Hours

TEXT BOOKS:

1. Bali N. P and Manish Goyal, ―Text book of Engineering Mathematics, Third edition, Laxmi Publications (p) Ltd., 2008.

2. Grewal. B.S, ―Higher Engineering Mathematics, 40th Edition, Khanna Publications, Delhi, 2007.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma,” Higher Engineering Mathematics”, S. Chand Private Ltd.,2011.

2. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2012.

3. Peter V. O’Neil,” Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.

4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, NewDelhi, 2008.

5.Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics”, Volume I, Second Edition, PEARSON Publishing, 2011.

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)				
Course Code UBPHC01	Course Name Engineering Physics-I		**L** 3	**T** 0	**P** 0	**C** 3
Year and Semester	I Year & I Semester		Contact Hours Per Week 3 Hrs			
Prerequisite course	Nil					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
	√					
Course Objectives	1. To understand the basic mechanics of solids and fluids, their properties and applications. 2. To learn the basic principles of Electromagnetic induction, Electricity and electrical machines.					
Course Outcomes	After successful completion of Course, the students will be able to 1. Summarize the laws and principles of basic mechanics 2. Explain the concepts of hydrostatics and hydrodynamics 3. Illustrate the properties of matter 4. Demonstrate the basic principles of heat and light 5. Outline the basic principles of electricity and electrical machines 6. Apply the fundamentals of electromagnetic induction for engineering applications					

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	1	2	-	-	-	-	-	-	2	2	2	3
CO2	2	-	2	2	2	-	-	-	-	-	-	2	2	3	3
CO3	2	2	-	1	2	-	-	-	-	-	-	-	2	-	-
CO4	2	2	2	-	2	-	-	-	-	-	-	2	2	2	2
CO5	3	2	2	2	3	-	-	-	-	-	-	2	2	3	2
CO6	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
AVERAGE	2.3	2.4	2.3	1.8	2.3	-	-	-	-	-	-	2.2	2	2.6	2.4
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: MECHANICS 9 Hrs

Force-inertia – Newton`s laws of motion- impulse and impact – Friction – cause of friction – types of friction – laws of friction – coefficient of friction – angle of friction. Motion-types of motion – simple harmonic motion – simple pendulum – circular motion –centripetal and centrifugal force – conical pendulum-working of a steam engine governor based on the principle of conical pendulum. Newton`s law of universal gravitation – Satellite-principle of launching of satellite – orbital velocity – time period

– escape velocity. Planetary motion and Kepler's Laws – Deduction of Kepler`s third law – Law of gravitation from Kepler`s third law.

UNIT II: HYDROSTATICS AND HYDRODYNAMICS 9 Hrs

Fluid-Pascal`s law – Archimedes principle – Laws of floatation – centre of buoyancy – stability of equilibrium of a floating body – metacentre – metacentric height of a ship – experiment. Hydrostatic pressure, differential manometer – Centre of pressure – Centre of pressure of a rectangular lamina immersed in a homogenous liquid at rest – Centre of pressure of a triangular lamina with one side parallel to the surface-Surface tension – angle of contact – capillarity – derivation of surface tension. Viscosity – Viscous Force-Stokes Law – coefficient of viscosity – experiment to find coefficient of viscosity. Bernoulli's Theorem – Venturimeter – Plimsol lines.

UNIT III: PROPERTIES OF MATTER 9 Hrs

Elasticity- stress and strain – Hooke`s law – modulus of elasticity – different types – Poisson ratio Torsion – torque per unit twist – work done in twisting – Torsion pendulum – theory and experiment – bending of beams – bending moment – Cantilevers – depression of a cantilever – non uniform bending and uniform bending – theory and experiment.

UNIT IV: HEAT AND LIGHT 9 Hrs

Laws of thermodynamics – Specific heat capacity – Specific heat capacity of gases – CP and CV – Relation between them – Transmission of heat – conduction – coefficient of thermal conductivity – Lee,s disc experiment – cylindrical flow of heat – convection – radiation – Black body radiation – distribution of energy – Wien`s displacement law– Rayleigh Jeans law. Interference – Double slit experiment-Diffraction due to single slit and circular aperture. Limit of resolution, Resolving power of optical instruments.

UNIT V: ELECTRICITY 9 Hrs

Heating effect of current – Joules law of heating – Applications – fuse – thermopile. Ampere`s Law, Biot Savart law – Magnetic field at a point due to straight conductor carrying current – Kirchhoff's current and voltage laws – Whetstone's network – Electromagnetic induction – Faraday's laws of Electromagnetic induction – Lenz law – Self induction – Mutual induction . DC Generator – principle, construction and working – AC Generator – principle, construction and working. Transformer – principle, construction and working – Losses in transformer – methods to reduce the losses.

TOTAL: 45 Hours

TEXT BOOKS:

1. A Nelson, "Engineering Mechanics" Tata McGRaw Hill, 2009
2. M. Narayanamurthi, M. Nagarathnam, "Statics, Hydrostatics and Hydrodynamics", The National Publishing Company, 8th Edition, 2008.
3. R. Murugeshan, Properties of matter and acoustics, S. Chand & Co, New Delhi 2012.
4. D.S. Mathur, Elements of properties of matter, S.Chand & Company Ltd., New Delhi 2010.
5. Brijlal, N. Subramanyam and P.S. Hemne "Heat and thermodynamics", S.Chand & Co, New Delhi 2008.
6. N. Subramanian, Brijlal and M.N. Avadhanulu, A text book of Optics, S. Chand & Co, New Delhi, 2012.

REFERENCES:

1. R Feynmann, R Leighton, M Sands, “The Feynmann Lectures on Physics”, Volume 1, Pearson Education; 1st edition 2012.
2. D Halliday, R Resenic and J Walker “Fundamentals of Physics”, Wiley India, 6th edition, 2006.
3. Brijlal and Subramaniyam, “Properties of matter”, S. Chand & Co, New Delhi, Revised edition,2008.
4. R W. Fox, A T. McDonald, P J. Pritchard John, “Introduction to Fluid Mechanics”, Wiley & Sons, 6th edition, 2008.
5. E M. Purcell and Morin, “Electricity and Magnetism”, 3rd Edition, Cambridge University Press, 2011
6. A Ghatak, “Optics”, McGraw-Hill Education; 1st Edition, 2009

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)				
Course Code UBCHC01	Course Name Engineering Chemistry	**L** 3	**T** 0	**P** 0	**C** 3
Year and Semester	I Year & I Semester	Contact Hours Per Week 3 Hrs			
Prerequisite course	Nil				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
	√				
Course Objectives	1. To impart a sound knowledge with respect to Phase rule, Hazardous Chemicals, and treatment of water for industrial purpose. 2. To understand principle involved in corrosion control, the concept of energy storage devices and the importance of fuels. 3. To develop polymer based materials and functional materials towards different applications.				
Course Outcomes	After successful completion of Course, the students will be able to 1. Illustrate the fundamentals of phase rule and reduced phase rule 2. Outline the concepts of water treatment techniques 3. Identify the types of fuels and characterization of various constituents 4. Illustrate the basic principles of electrochemical reactions and redox reactions 5. Distinguish the production technologies of metallic and non-metallic materials 6. Make use of corrosion Control techniques in on- board ship				

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	2	-	-	-	-	2	1	2	2
CO2	2	2	-	-	-	-	3	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	3	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	3	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	2	2	2
CO6	3	2	3	-	2	-	3	-	-	-	-	-	2	2	3
AVERAGE	2.3	1.6	3	-	2	-	2.8	-	-	-	-	2	1.6	2	2.3
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM)						3. SUBSTANTIAL (HIGH)			

UNIT- I PHASE RULE **9 Hrs**

Terminology-Phase rule – one component system, reduced phase rule – application of reduced phase rule to binary alloy system-Hazard of Inorganic, Organic cargos carried on board vessels with respect to flammability, toxicity, reactivity and solubility.

UNIT- II WATER & IT TREATMENTS **9 Hrs**

Sources of water - hard and soft water-determination of hardness - Softening of water - lime soda process Ion exchange process - Boiler feed water - removal of oil - blow down operation - Caustic Embrittlement -Internal conditioning - Water for domestic purposes screening - aeration, sedimentation, Chlorination, break point chlorination - Disinfection with ozone – desalination - Waste water treatment- marine sediments.

UNIT -III FUEL & COMBUSTION 9 Hrs

Conventional & non-conventional energy resources and energy conversion - classification and properties of fuel - calorific value determination using bomb calorimeter - Solid fuels – Analysis - proximate and ultimate analysis, hydrogenation & carbonization of coal - Liquid fuels - characterization of various constituents viz petrol diesel with regard to their application in IC engine (knocking)Gaseous fuels- coal gas, producer gas, biogas, water gas and flue gas analysis using Orsat apparatus - Toxic and other ill effects of cargos on human and environment.

UNIT -IV ELECTROCHEMISTRY 9 Hrs

Electrodes - Standard & single electrode potential - Nernst equation - Cell terminology - cell reaction - Galvanic cells - fuel cells - Lead acid battery - Nickel cadmium battery - Electrochemical Reaction: Electrolysis - Electroplating – galvanizing - Corrosion Control on Board Ship: Thermodynamics & Kinetics of corrosion - various forms of corrosion - corrosion prevention methods.

Lubricants: Classification and properties of lubricating oils (Viscosity, flash, fire point & cloud and pour points) Effects of pressure on melting & boiling point - Relevance of gas laws to LPG carrier and reefer ships. Physical and Chemical Properties of Fuels and Lubricants - Production of Oils from Crude Oil - Properties and characteristics of fuels and lubricants - Shore side and shipboard sampling and testing - Interpretation of test results - Contaminants including microbiological infection - Treatments of fuels and lubricants including storage, centrifuging, blending, pretreatment and handling.

UNIT- V 9 Hrs

Production of steel - Bessemer converter process - Open hearth process - Chemical addition to steels production of non-ferrous alloys, brass, bronze, aluminum alloys - Special reference to ship building (ship propellers etc) – Cement - manufacturing of cement - setting & hardening of cement – concrete - reinforced concretes - Basic Metallurgy - Metals and Processes - Properties and Uses - Non-Metallic Materials - Characteristics and limitations of process used for fabrication and repair – Process - Heat Treatment of Carbon Steel - Technology of Material - Metallurgy of Steel and Cast Iron - Properties and application of material used in machinery on board ship.

Organic Compounds: Hydrocarbon- petroleum & its fractionated products - extraction of aromatic compounds from Petroleum - Aromatic compounds – Benzene - polycyclic hydrocarbons- Naphthalene, anthracene, Naphthacene - Fiber and Reinforced plastics.

Total: 45 Hours

TEXT BOOK:

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

REFERENCES:

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.,), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

PROGRAM	B.E (Naval Architecture & Offshore Enggneering)				
Course Code UBITC01	Course Name Fundamentals of Computer Programming	L 3	T 0	P 0	C 3
Year and Semester	I Year & I Semester	Contact Hours Per Week 3 Hrs			
Prerequisite course	Nil				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
		√			

Course Objectives	1. To explain the problem solving concepts using a computer. 2. To develop problem solutions for the computer by using problem solving tools. 3. To describe the Programming structure of C language. 4. To convert an Algorithm, Pseudo code and Flowchart into a C program. 5. To find errors and execute a C program.
Course Outcomes	After successful completion of Course, the students will be able to 1. Outline the basic organization of computer and introduction to number system 2. Demonstrate problem-solving concepts of computer 3. Explain the concepts of data structure 4. Illustrate the structure of C Language 5. Make use of syntax for writing programs in C language materials 6. Infer the knowledge of computer and programming in C

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	2	-	-	-	-	-
CO4	2	2	2	-	1	-	-	-	-	2	-	-	-	-	-
CO5	2	2	2	-	3	-	-	-	-	2	-	2	-	-	-
CO6	3	3	3	2	3	-	-	-	-	2	-	2	-	-	-
AVERAGE	2.5	2.5	2.3	2	2	-	-	-	-	2	-	2	-	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: INTRODUATION **9 Hrs**

Generations and Classification of Computers - Applications of Computers - Basic Organization of a Computer - Number system - Binary, Decimal, Octal and Hexadecimal - Problems

UNIT- II:- INTRODUATION TO PROBLEM SOLVING AND PROGRAMMING **9 Hrs**

General Problem - Solving Concepts - Problem Solving Concepts for the Computer - An Introduction to Programming Structure - Problem Solving with the Sequential Logic Structure - Problem Solving with Decisions - Problem Solving with Loops

UNIT- III:- DATA STRUATURES **9 Hrs**

Primary Data Types - One-dimensional Arrays - Two-dimensional Arrays - Table Look-Up Technique - Sequential Search, Binary Search - Sorting Techniques - Selection Sort, Bubble Sort, Shell Sort, Stacks, and Queues - File Concepts

UNIT- IV:- PROGRAMMING STRUATURE OF C LANGUAGE **9 Hrs**

Importance of C - Basic Structure of a C Program – Constants, variables and data types- Operators and Expressions - Input and Output Operations - Branching and Looping - Arrays and Strings - User-defined Functions

UNIT –V:- PROGRAMMING IN C LANGUAGE **9 Hrs**

Structures and Unions – Pointers - File Management in C - Development of C programs - Executing a C Program - compilation and linking - Common Programming Errors - Program Testing - Program Debugging

Total: 45 Hours

TEXT BOOKS:

1. Maureen Sprankle & Jim Hubbard, “Problem Solving & Programming Concepts”, Sixth Edition, Prentice Hall, 2012.
2. E. Balagurusamy, “Programming in ANSI C”, Seventh Edition, McGraw Hill India, 2016.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

REFERENCES:

1. Ashok Kamthane, “Programming in C”, Third Edition, Pearson Education India, 2015.
2. Herbert Schildt, “C: The Complete Reference”, Fourth edition, McGraw Hill Education, 2000.
3. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGrawHill, 2006.
4. Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)				
Course Code	Course Name	L	T	P	C
UBBTC01	Environmental Studies	2	0	0	2
Year and Semester	I Year & II Semester	Contact Hours Per Week			
Prerequisite course	Nil	2 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
	√				

Course Objectives	1. To study the interrelationship between living organism and environment. 2. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.
Course Outcomes	After successful completion of Course, the students will be able to 1. Implement scientific, technological, economic and political solutions to environmental problems. 2. Identify the interrelationship between living organism and environment. 3. Understand the importance of environment by assessing its impact on the human world 4. Analyze the vision the surrounding environment, its functions and its value. 5. Discuss the development and improvement in std. of living. 6. Classify the integrated themes such as biodiversity, natural resources, pollution control and waste management.

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	2	3	2	-	1	-	-	-	-	-	-	2	-	-	-
CO4	2	2	-	2	2	-	-	-	-	-	-	2	3	-	-
CO5	3	2	2	2	1	-	-	-	-	-	-	3	-	-	-
CO6	3	3	2	2	3	-	-	-	-	-	-	2	2	-	-
AVERAGE	**2.7**	**2**	**2**	**2**	**1.8**	-	-	-	-	-	-	**2.3**	2.3	-	-
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM)						3. SUBSTANTIAL (HIGH)			

UNIT I: **9Hrs**

Environmental studies – terminologies – need for public awareness – Natural resources – Renewable and non – renewable resources – Characteristics, uses and conservation of natural resources-Forest resources,

Water resources, Mineral resources, Food resources, Energy resources and Land resources – Role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.

UNIT II: **9Hrs**

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the different ecosystems – Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT III: **9Hrs**

Introduction – Definition : genetic, species and ecosystem diversity – Biogeographical classification of India –Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – Inida as a mega-diversity nation Hot-sports of biodiversity– Threats to biodiversity - Endangered and endemic species of India – Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity**.**

UNIT IV: **9Hrs**

Environmental Pollution – Cause, effects and control measures of different types of pollution-Solid waste Management –Role of an individual in prevention of pollution – Disaster management. Social Issues and the Environment – from Unsustainable to Sustainable development – Urban problems related to energy – Water conservation – Resettlement and rehabilitation of people – its problems and concerns- Environmental ethics – Climate change, global warming, nuclear hazards, ill-effects of fireworks – Wasteland reclamation – Laws and acts in India for environment protection , Public awareness.

UNIT V: **9Hrs**

Population growth-variation among nations-Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare– Role of Information Technology in Environment and human health. Field work and Field Visit.

Total: 30 Hours

TEXT BOOK:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2006.

REFERENE BOOKS:

1. Agarwal K.C. Environmental Biology, Nidi Publications Limited, Bikaner, India, 2001.
2. Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses. University Grants Commission, New Delhi , 2013.
3. N. Arumugam and V Kumaresan, Environmental Studies (UGC Syllabus), Saras Publications, Nagercoil, India, 2014.
4. D.K. Asthana and Meera Asthana, A Textbook of Environmental Studies. S. Chand Publishing, New Delhi, 2010.
5. B.S. Chauhan, Environmental Studies. Laxmi Publications, New Delhi, 2015

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)				
Course Code UBMCCPA	Course Name Engineering Graphics	**L** 2	**T** 0	**P** 2	**C** 3
Year and Semester	I Year & I Semester	Contact Hours Per Week 4 Hrs			
Prerequisite course	Nil				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
		√			
Course Objectives	1. Develop the ability of students to understand graphic skills for communication of Concepts. 2. To analyze and design ideas of engineering products.				
Course Outcomes	After successful completion of Course, the students will be able to 1. Identify the three Dimensional objects in two-dimensional media 2. Construct the projection of points, straight lines and determination of true length and true inclination 3. Illustrate the simple solid on plain surface 4. Demonstrate the projection of solids and development of surfaces 5. Construct the isometric projection of simple solids 6. Examine the different isometric views and projections				

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	1	-	-	-	-	-
CO2	3	3	2	3	1	-	-	-	-	2	-	-	-	2	-
CO3	2	2	3	2	2	-	-	-	-	3	-	-	-	2	-
CO4	3	3	2	2	1	-	-	-	-	1	-	-	3	-	-
CO5	3	2	2	3	3	-	-	-	-	2	-	-	2	-	2
CO6	3	3	2	2	3	-	-	-	-	3	-	2	-	-	2
AVERAGE	2.7	2.5	2.2	2.3	2	-	-	-	-	2	-	2	2.5	2	2
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT-I PLANE CURVES AND ORTHOGRAPHIC VIEWS **6 Hrs**

Introduction-Use of drafting instruments-Drawing conventions-size-Line types-Lettering and dimensioning Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves Visualization concepts: Representation of

Three Dimensional objects in two dimensional media-Visualization of objects from pictorial views to orthographic views

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 6 Hrs

Orthographic projection: Principal views and principal planes of projection-First angle projection- Third angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes -Determination of true lengths and true inclinations by rotating line method-Projection of plane surfaces

UNIT III PROJECTION OF SOLIDS 6 Hrs

Projection of simple solids placed in Different positions-perpendicular to HP or VP-parallel to either HP or VP and inclined to the other-Inclined to both VP and HP

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6 Hrs

Sectioning of simple solids in simple vertical position when the cutting plane is inclined to the one of the principal planes-Development of lateral surfaces of simple solids by Parallel line method and radial line method

UNIT V ISOMETRIC PROJECTION AND ISOMETRIC VIEWS 6 Hrs

Principles of isometric projection-isometric projection of simple solids-Guide lines to read the isometric view visualizing of plane surfaces inclined to the direction of view.

TOTAL: 60 Hours

TEXT BOOKS:

1. Bhatt N.D. and Panchal V.M., Engineering Drawing. Charotar Publishing House, 50th Edition, 2010.
2. Gopalakrishna K.R., Engineering Drawing. (Vol. I & II combined), Subhas Stores, Bangalore, 2007.
3. Luzzader, Warren.J. and Duff,John M., Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005

REFERENCES:

1. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
3. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
4. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)					
Course Code	Course Name		L	T	P	C
UBCHCPA	Engineering Chemistry Laboratory		0	0	2	1
Year and Semester	I Year & I Semester		Contact Hours Per Week			
Prerequisite course	Nil		2 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
	√					
Course Objectives	1. To make the student to develop practical skills in the determination of water quality parameters through volumetric analysis. 2. To enlighten the student on instrumental methods for estimation of pH, conductivity, metal ion content, determination of molecular weight and degree of dissociation of a polymer by viscometry.					
Course Outcomes	After successful completion of Course, the students will be able to 1. Illustrate how to estimate Bicarbonate and Hydroxide Alkalinity 2. Explain how to calculate Total Hardness and Chloride Content of water 3. Demonstrate how to estimate Temporary and Permanent Hardness, COD, BOD,TDS and TSS of water 4. Compare the titration methods of acid, base and Ferrous ion 5. Determine Single Electrode potential of Galvanic cell and Molecular weight and degree of dissociation of a polymer 6. Explain how to determine Proximate analysis of fuel and its Calorific value					

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	2	-	-	-	-	2	3	-	2	1	2	2
CO2	2	2	-	1	-	-	2	-	3	2	-	-	-	-	-
CO3	2	1	-	2	2	-	2	-	2	3	-	-	-	-	-
CO4	2	1	-	3	2	-	3	-	3	2	-	-	-	-	-
CO5	3	2	-	2	2	-	-	-	2	3	-	-	2	2	2
CO6	3	2	3	2	2	-	3	-	3	2	-	-	2	2	3
AVERAGE	2.3	1.6	3	2	2	-	2.5	-	2.5	2.5	-	-	1.7	2	2.3
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

List of Experiments:

1. Estimation of Bicarbonate Alkalinity
2. Estimation of Hydroxide Alkalinity
3. Estimation of Total Hardness of Water
4. Estimation of Chloride Content of Water
5. Estimation of Temporary and Permanent Hardness
6. Estimation of COD & BOD of Water, TDS and TSS (Demo only)
7. Conduct metric Titration of a strong acid and base.
8. PH titration of a strong acid and strong base
9. Potentiometric titration of Ferrous Ion
10. Determination of Single Electrode potential (Galvanic Cell)
11. Determination of Calorific value of a solid fuel
12. Determination of Molecular weight of a polymer.
13. Determination of degree of dissociation of a polymer.
14. Proximate analysis of a solid fuel / Liquid fuel

TOTAL : 30 Hours

<table>
<tr><td>PROGRAM</td><td colspan="6">B.E (Department Of Naval Architecture And Offshore Engineering)</td></tr>
<tr><td>Course Code
UBITCPA</td><td colspan="2">Course Name
Fundamentals Of Computer Programming Laboratory</td><td>L
0</td><td>T
0</td><td>P
2</td><td>C
1</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I Year & I Semester</td><td colspan="4" rowspan="2">Contact Hours Per Week
2 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td></td><td>√</td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objectives</td><td colspan="6">1. To write C programs to solve the problems
2. To compile and execute programs in C
3. To identify the syntax errors and semantic errors
4. To debug the program in C
5. To write C programs to solve the problems</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">After successful completion of Course, the students will be able to
1. Develop logics to swap two numbers, finding largest of given numbers and roots of quadratic equation
2. Develop logic to print Fibonacci Series and sum of odd numbers and to find the area and Perimeter of the Circle, Triangle, and Square
3. Show maximum, minimum, Sum and average of elements of an array
4. Determine the sum and multiplication of two matrices
5. Determine whether a string is palindrome or not and find number of vowels and of consonants in a given string
6. Develop logic to perform the operations using function and pointer</td></tr>
</table>

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1		-	-	-	-	2	-	1	-	-	-
CO2	3	2	3	2	-	-	-	-	-	2	-	2	-	-	-
CO3	3	2	3	2	2	-	-	-	-	1	-	2	-	-	-
CO4	2	2	2	1	2	-	-	-	-	1	-	2	-	-	-
CO5	2	2	2	2	2	-	-	-	-	2	-	2	-	-	-
CO6	2	3	3	2	3	-	-	-	-	2	-	2	-	-	-
AVERAGE	2.3	2.2	2.5	1.7	2.3	-	-	-	-	1.7	-	1.8	-	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

LIST OF PROGRAMS:

1. Program to Swap of Two numbers without using Third variable
2. Program to find the Largest of the given three numbers
3. Program to find the roots of the Quadratic Equation
4. Program to find the Reverse of the given number
5. Program to print the Fibonacci Series
6. Program to display series and find the sum of 1+3+5+……..+n
7. Program to find the Area and Perimeter of the Circle, Triangle, and Square using switch and while statements
8. Program to find the maximum and minimum numbers in an array
9. Program to show the Sum of 10 elements of an array and show the Average
10. Program to find the sum of two matrices
11. Program to find the Multiplication of two matrices
12. Program to find whether a string is palindrome or not.
13. Write a program to find number of vowels and number of consonants in a given string
14. Program to swap the numbers using pointer
15. Program to perform Mathematical operation using function

Total – 30 Hours

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)					
Course Code	Course Name		L	T	P	C
UBLECPB	Soft skills-I		0	0	4	2
Year and Semester	I Year & I Semester		Contact Hours Per Week			
Prerequisite course	Nil		4 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	√					
	Basic Science	Engineering Science	Open Elective		Mandatory	

Course Objectives

1. To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions, seek clarifications.
2. To help learners develop their speaking skills and speak fluently in real contexts.
3. Making them realise the importance of English as Global language and its importance in today‘s scenario.

Course Outcomes

After successful completion of Course, the students will be able to

1. Develop skills in informal conversation; comprehend their views without making grammatical errors
2. Define their perspective more operationally
3. Infer the delicacy of using the linguistics skills
4. Make use of listening and speaking skills for effective presentation
5. Develop good attitude and behavior
6. Build interview skills and personality development

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	2	1	2	2	-	2	-	-	-
CO2	-	-	-	-	-	2	1	2	2	3	-	2	-	-	-
CO3	-	-	-	-	-	2	1	2	2	2	-	3	-	-	-
CO4	-	-	-	-	-	2	2	1	2	1	-	3	-	-	-
CO5	-	-	-	-	-	3	2	1	3	2	-	1	-	-	-
CO6	-	-	-	-	-	2	1	2	1	2	-	2	-	-	-
AVERAGE	-	-	-	-	-	2.3	1.5	1.5	2	2	-	2.2	-	-	-

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT 1: GRAMMAR AND FOUNDATON **18 Hrs**

Training the students on basic grammar and foundation and laying the standard platform-A complete standard syllabus of Cambridge is used-The main part of the 1st semester is to cover the major tenses (Present tense, Present Continuous, Past Tense, Past Continuous, Present Perfect, and Present Perfect continuous).

UNIT II: FOCUS ON LANGUAGE – VOCABULARY **4 Hrs**

General Vocabulary-Dictionary-Word Formation: Prefix and Suffix-Synonyms and antonyms- Idioms and Phrases- Diplomatic Phrases – Food Phrases- Vocabulary-Words commonly misspelt – Lab-Test**.**

UNIT III: INTERACTIVE ENGLISH **10 Hrs**

The main objective is English for International communication-It course contains conversations, snapshots, readings, activities, a greater variety and amount of listening materials and more visuals to introduce vocabulary, more opportunities to build fluency, and up-to-date art and design- The course covers the fours skills of listening, speaking, reading and writing, as well as improving pronunciation and building vocabulary.

UNIT IV: LISTENING AND SPEAKING **14 Hrs**

Types of Listening -Listening and note taking-Pronunciations-Stress and Intonation- Conversation technique-Dialogue Writing -Professional Communication-Interview-Group Discussion –Power point Presentation-Debate , Oratorical Lab

UNIT V: INTERVIEW SKILLS AND PERSONALITY DEVELOPMENT 14 Hrs

Out of box thinking -Lateral Thinking- Intrinsic and Extrinsic Motivators- Factors influencing Attitude-Challenges and lessons from Attitude- Etiquette-Value of time- Diagnosing Time Management- Weekly Planner To do list- Prioritizing work.

TOTAL: 60 Hours

TEXT BOOKS:

1. Essential Grammar in use- Raymond Murphy ,Cambridge , New Third Edition

REFERENCE BOOKS:

1. New Interchange (English for International Communication) Jack C. Richards

SEMESTER: II

<table>
<tr><td>PROGRAM</td><td colspan="5">B.E (Department Of Naval Architecture And Offshore Engineering)</td></tr>
<tr><td>Course Code
UBLEC02</td><td colspan="2">Course Name
Technical English - II</td><td>L
2</td><td>T
0</td><td>P
0</td><td>C
2</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact Hours Per Week
2 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td colspan="2">Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td>√</td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td colspan="2">Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Course Objectives</td><td colspan="6">1. To make the students learn to speak grammatically correct English. Guiding and supporting their skill development –Listening, speaking, reading and writing in English..
2. Making them realize the importance of English as Global language and its importance in today‘s scenario.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">After successful completion of Course, the students will be able to
1. Identify the importance of technical English
2. Make use of English grammar and enhancing vocabulary
3. Develop skills in reading
4. Build knowledge on writing letters and descriptive writings
5. Develop speaking and listening skills
6. Apply the correct pause and pronunciation</td></tr>
</table>

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	-	2	2	-	2	-	-	-
CO2	-	-	-	-	-	3	2	-	1	2	-	1	-	-	-
CO3	-	-	-	-	-	2	1	-	2	1	-	2	-	-	-
CO4	-	-	-	-	-	2	2	-	2	2	-	2	-	-	-
CO5	-	-	-	-	-	2	2	-	2	1	-	2	-	-	-
CO6	-	-	-	-	-	1	3	-	1	2	-	2	-	-	-
AVERAGE	-	-	-	-	-	2	2	-	1.7	1.7	-	1.8	-	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: COMMUNICATION & FOCUS ON LANGUAGE **6 Hrs**

Process of Communication -Language as a tool of Communication-Importance of Technical Communication.

UNIT II: VOCABULARY & ENGLISH GRAMMAR **6 Hrs**

General Vocabulary-Dictionary-Word Formation: Prefix and Suffix-Synonyms and antonyms- Idioms and Phrases-Homophones -Parts of Speech-Subject Verb Agreement-Tenses, Articles, Prepositions-Common errors in English General Vocabulary - Adverbs- Gerund and Infinitive – Word Formation: Prefix and Suffix - Noun - Compound Noun- Adjective – Degrees of Comparison – Double Adjective - Voice -Tense – Verbs - Homograph, Homophone – Commonly Confused Words - Collocation – Punctuation marks.

UNIT III: READING SKILL **6 Hrs**

Intensive Reading-Skimming &Scanning - Extensive Reading –Meta cognitive reading - Topic sentence and its Role-Reading and Interpretations- Critical Reading – Reading and summarizing

UNIT IV: WRITING SKILL **6 Hrs**

Descriptive Writing –Paragraph-Technical descriptions-Essays-Letter Writing – Formal and Informal-Business Letters-Job Application Letter-Types of reports-Instructions and Checklists Paragraph Writing-Descriptive Writing –Paragraph - Definition Writing – Extended Definition – Purpose Statement – Sequence words – E mail writing – Flow chart – pie chart – note taking – Dialogue writing – Circular writing- Latter to the editor – personal letter writing – circular writing

UNIT V: LISTENING AND SPEAKING 6 Hrs

Types of Listening -Listening and note taking-Pronunciations-Stress and Intonation- Conversation technique-Dialogue Writing -Professional Communication-Interview-Group Discussion –Power point Presentation-Lab Listening and note taking – Role play – Group Discussion

TOTAL: 30 Hours

TEXT BOOK:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012.
2. English and communication skills—S.P.Dhanavel. Orient Black swan (2010).

REFERENCE BOOKS:

1. Essential Grammar use – Raymond Murphy, Cambridge (2007).

2. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008.
3. Muralikrishna & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011.
4. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007.

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)					
Course Code	Course Name		**L**	**T**	**P**	**C**
UBMTC02	Engineering Mathematics-II		3	1	0	4
Year and Semester	I Year & II Semester		Contact Hours Per Week			
Prerequisite course	Nil		4Hrs			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
	√					
Course Objectives	1. To provide the required skill to apply the concepts of ordinary differential equations. 2. To provide the required ideas to solve the problems on higher order ordinary differential equations. 3. To acquaint the student with the concepts of vector calculus needed for problems in engineering discipline. 4. To understand the standard techniques of complex variable problems. 5. To create a new domain to handle the problem in easier by using transforms.					
Course Outcomes	After successful completion of Course, the students will be able to 1. Infer knowledge on ordinary differential first order equations 2. Illustrate the use of ordinary differential higher order equations 3. Solve problems using vector calculus 4. Demonstrate the properties of analytic functions 5. Apply Laplace transforms in engineering applications					

	6. Apply differential equations, vector calculus and Laplace transforms in engineering applications

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2		-	-	-	-	-	-	-	2	2	2
CO2	3	2	3	2		-	-	-	-	-	-	3	2	2	2
CO3	2	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO4	3	2	3	2		-	-	-	-	-	-	2	2	2	2
CO5	2	3	2	3		-	-	-	-	-	-	2	3	2	3
CO6	3	2	3	2	1	-	-	-	-	-	-	2	3	2	2
AVERAGE	2.7	2.3	2.7	2.2	1	-	-	-	-	-	-	2.3	2.3	2	2.2
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I -ORDINARY DIFFERENTIAL EQUATIONS–FIRST ORDER AND APPLICATION 12Hrs

Definition - order and degree - formation of differential equation - Solution of first order - first degree equations in variable separable form - homogeneous equations - other substitutions - Equations reducible to homogeneous and exact differential equations - Equations reducible to exact Integration Factor - Linear differential equation of first order first degree, reducible to linear - Applications to electrical circuits and orthogonal trajectories.

UNIT II -ORDINARY DIFFERENTIAL EQUATIONS–HIGHER ORDER AND APPLICATIONS 12 Hrs

Higher (nth) order linear differential equations - definition and complementary solution- Methods of obtaining PI, Method of variation of parameters - Method of undetermined coefficients - Cauchy's Homogeneous LDE and Legendre's equations - System of Ordinary Differential Equations Simultaneous equations in symmetrical form.

UNIT III -VECTOR CALCULUS 12 Hrs

Gradient Divergence and Curl – Directional derivative – irrotational and solenoidal vector fields –Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT IV- ANALYTIC FUNCTIONS 12 Hrs

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping - bilinear transformation.

UNIT V- LAPLACE TRANSFORM 12 Hrs

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties– Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions. Definition of Inverse Laplace transforms as contour integral –

Convolution theorem (excluding proof) – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 60 Hours

TEXT BOOK:

1. Bali N. P and Manish Goyal, ―Text book of Engineering Mathematics, 3rd Edition, Laxmi Publications (p) Ltd., 2008.
2. Grewal. B.S, ―Higher Engineering Mathematics, 40thEdition, Khanna Publications, Delhi, 2007.

REFERENCE BOOKS:

1. Ramana B.V, ―Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, ―Advanced Engineering Mathematics, 3rdEdition, Pearson Education, 2007.
3. Erwin Kreyszig, ―Advanced Engineering Mathematics, 7thEdition, Wiley India, 2007.
4. Jain R.K and Iyengar S.R.K, ―Advanced Engineering Mathematics, 3rdEdition, Narosa Publishing House Pvt., 2007.

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)					
Course Code UBPHCO2	Course Name Engineering Physics-II		**L** 3	**T** 0	**P** 0	**C** 3
Year and Semester	I Year & II Semester		Contact Hours Per Week 3 Hrs			
Prerequisite course	Nil					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
	√					
Course Objectives	Students should understand about properties of light and sound waves and relate their significance for the development of technology					

Course Outcomes	After successful completion of Course, the students will be able to 1. Demonstrate the applications of sound waves 2. Explain the principles of laser and its applications 3. Illustrate miller indices and X-Ray power diffraction method to identify crystal structure 4. Compare the electrical conductivity in semiconductors and superconductors 5. Contrast dielectric and magnetic materials 6. Infer the principles of light and sound waves in various applications

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-		1	2	2
CO2	2	1	2	2	-	-	-	-	-	-	-		2	1	2
CO3	3	2	1	2	-	-	-	-	-	-	-	-	1	-	-
CO4	2	3	2	1	1	-	-	-	-	-	-		1	2	2
CO5	3	3	2	2		-	-	-	-	-	-	1	2	2	2
CO6	3	2	2	1		-	-	-	-	-	-	2	2	2	2
AVERAGE	2.5	2.2	1.7	1.6	1	-	-	-	-	-	-	1.5	1.5	1.8	2
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT – I: ACOUSTICS AND ULTRASONICS: 9 Hrs

Wave-types of waves-wave motion. Sound- classification of sound – characteristics of musical sound. Loudness – Weber Fechner law – Decibel – Reverberation – Reverberation time – Sound absorption coefficient- Sabine's formula for determining reverberation time (Rate of Growth and Rate of Decay) – determination of sound absorption coefficient – Factors affecting acoustics of buildings (Optimum reverberation time, loudness, focusing, eco, echelon effect, resonance and noise) and their remedies. Ultrasonics- production- piezo-electric method – SONAR-Ultrasonic flaw detector as non-destructive testing technique.

UNIT-II: LASER AND FIBRE OPTICS: 9 Hrs

Laser-principle-properties – Einstein coefficient (A and B)-Nd-YAG laser – CO2 laser- Applications of laser – Holography-construction and reconstruction of a hologram – Principle and propagation of light in an optical fibre-types of optical fibres – applications-fibre optic communication system (block diagram) – fibre optic sensors.

UNIT-III: CRYSTAL PHYSICS: 9 Hrs

Lattice-unit cell – Bravais lattice – lattice planes – Miller indices – 'd' spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius-coordination number – packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) – X-ray - Powder diffraction method to identify crystal structure parameters.

UNIT-IV: SEMICONDUATORS AND SUPERCONDUATORS 9 Hrs

Semiconductors – intrinsic and extrinsic semiconductor. Fermi level –Variation of Fermi level with temperature-electrical conductivity. Band gap determination-Hall effect – Determination of Hall coefficient – Applications. Superconductivity: Properties – Type I and Type II superconductors – BCS theory of superconductivity-High Tc superconductors-Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT-V: DIELECTRIC, MAGNETIC AND NEW ENGINEERING MATERIALS 9 Hrs

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarizations-frequency and temperature dependence on polarization-internal field – Claussius-Mosotti relation – uses of dielectric materials. Magnetic properties – diamagnetic – paramagnetic – ferromagnetic materials – super paramagnetism – Transducers. Properties and applications of metallic glasses – nano materials – shape memory alloys – bio materials.

TOTAL: 45 Hours

TEXT BOOKS

1. S. O Pillai "Solid State Physics", New Age International Pvt Ltd; 7th edition, 2015.
2. Ajoy Ghatak , "Optics", McGraw-Hill Education; 1st edition 2009.
3. Ajoy Ghatak, "Introduction to Fiber optics", Foundation Books, 2002.

REFERENCES BOOKS:

1. Charles Kittel," Introduction to Solid state physics", Wiley; Eighth edition 2012.
2. Ghatak and Thyagarajan, "Laser Fundamentals and Applications", Springer, 2011.
3. Richard Feynmann, Robert Leighton and Matthew Sands,"The Feynmann Lectures on Physics", Volume 1, Student Edition, Narosa Publishing house, 2003.
4. Richard Feynmann, Robert Leighton and Matthew Sands "The Feynmann Lectures" on Physics,Volume 2, Student Edition, Narosa Publishing house, 2003.

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)				
Course Code UBEEC01	Course Name Basics of Electrical & Electronics Engineering		**L** 3	**T** 0	**P** 0	**C** 3
Year and Semester	I Year & II Semester		Contact Hours Per Week 3 Hrs			
Prerequisite course	Nil					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
		√				
Course Objectives	1. To familiarize the basic laws, DC and AC theorems and the methods of analyzing electrical circuits. 2. To understand the characteristics and performance of Semiconductor					

	devices, Moving coil and moving iron instruments.
Course Outcomes	After successful completion of Course, the students will be able to 1. Know the Laws and analysis with different source in DC circuits. 2. Illustrate the operation of single phase AC Circuits. 3. Gain level on three phase AC Circuits. 4. Understand the performance characteristics of Semiconductor Devices. 5. Understand the basic concept of Electrical instruments. 6. Obtain knowledge on basis of Electrical & Electronics Engineering

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	-	-	-	-	-	-	2	2	2	2
CO2	3	3	2	2	2	-	-	-	-	-	-	2	2	2	2
CO3	2	3	3	2	-	-	-	-	-	-	-	2	2	3	3
CO4	3	3	2	3	-	-	-	-	-	-	-	1	3	2	2
CO5	3	3	2	3	2	-	-	-	-	-	-	2	2	3	3
CO6	3	3	3	2	-	-	-	-	-	-	-	1	3	2	2
AVERAGE	2.8	2.8	2.5	2.3	1.7	-	-	-	-	-	-	1.7	2.3	2.3	2.3
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: DC CIRCUITS **9 Hrs**

Importance of Electrical Engineering in day-to-day life - Electrical elements and their classifications - KCL and KVL equations - Loop current and node voltage method - Steady state analysis with independent and dependent sources - parallel and series circuits and star delta conversion.

UNIT II: ANALYSING SINGLE PHASE AC CIRCUITS **9 Hrs**

Common Signals and their Wave Form: RMS Value, Average Value, Form Factor and Peak Factor - Single-phase A.C Series Circuits: Types, Phasor Diagram, Power Factor, Impedance, Power Triangle - Single Phase A.C Parallel Circuits: Types, Phasor Diagram, Power Factor, Power Triangle – A.C Network Theorem's: Thevinin's and Norton's Theorem– Superposition Theorem – Maximum Power Transfer Theorem - Mesh Current and Node Voltage Method with A.C sources.

UNIT III: ANALYSING THREE PHASE AC CIRCUITS **9 Hrs**

Three Phase Balanced and Unbalanced Voltage Sources – Analysis of Three Phase 3-Wire and 4-Wire Circuits with Star and Delta Connected Loads, Balanced & Unbalanced – Phasor Diagram of Voltages and Currents – Power and Power Factor Measurements in Three Phase Circuits.

UNIT IV: SEMICONDUATOR DEVICES **9 Hrs**

Characteristics of PN Junction Diode-Zener effect-Zener Diode and its Characteristics- Voltage regulation-Bipolar Junction Transistor-CB, CE, CC Configurations and Characteristics- Basic Construction of 'N' channel & 'P' channel JFET-Half wave and Full wave rectifiers.

UNIT V: BASIC ELECTRICAL MEASUREMENTS **9 Hrs**

Construction and Operating Principles of Moving Coil and Moving Iron Instruments (Ammeter and Voltmeter), Dynamometer Type Wattmeter and Basic Torque Equations, Electrodynamics frequency meter, Energy Meter and Megger – Measurement Errors.

TOTAL: 45 Hours

TEXT BOOKS:

1. Arumugam and Prem Kumar, Electric Circuit Theory, Khanna Publishers, 2002.
2. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6 th edition, New Delhi, 2003
3. R.S.Sedha, A Textbook of Applied Electronics, 3rd revised edition Edition, 2008.
4. A.K.Sawhney-A Course in Electrical and Electronics Measurements and Instrumentation, 19th Revised Edition 2011.

REFERENCE BOOKS:

1. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.
3. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2003.

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)					
Course Code	Course Name		**L**	**T**	**P**	**C**
UBMCC03	Engineering Mechanics		3	1	0	4
Year and Semester	I Year & II Semester		Contact Hours Per Week			
Prerequisite course	Nil		4 Hrs			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
		√				

Course Objectives	1. Develop the ability to understand, formulate and analyze any engineering problem in a simple logical manner and to solve basic problems in Engineering Mechanics. 2. Further, he should understand the principle of work and energy
Course Outcomes	After successful completion of Course, the students will be able to 1. Explain the engineering principles dealing with force, displacement, velocity and acceleration 2. Build the knowledge on the equilibrium of rigid bodies 3. Examine rigid body subjected to dynamic forces 4. Use the fundamental concepts of kinematics and kinetics of particles to solve engineering problems 5. Determine Friction and its effects 6. Demonstrate the principles of work and energy

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	2	-	-
CO3	2	2	-	2	-	-	-	-	-	-	-	2	-	2	-
CO4	3	3	2	1	-	-	-	-	-	-	-	3	3	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	2	-	2	3
CO6	3	3	3	2	-	-	-	-	-	-	-	3	3	-	3
AVERAGE	2.5	2.7	2.2	1.5	-	-	-	-	-	-	-	2.5	2.5	2	3
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: BASICS & STATICS OF PARTICLES **12 Hrs**

Introduction - Units and Dimensions – Forces – System of forces – Resultant forces – Parallelogram law of forces – Triangular law of forces – Polygon law of forces – Resolution and composition of forces – Principles of transmissibility. Single equivalent force - Equilibrium of particles – Moment and couple – Scalar components of moment – Varigon‘s Theorem.

UNIT II: EQUILIBRIUM OF RIGID BODIES **12 Hrs**

Equilibrium of forces – Law of mechanics - Lami‘s theorem. - Free body diagram – Requirement of Stable Equilibrium – Equilibrium of rigid bodies in 2D – Examples - Type of supports and their support reactions.

UNIT III: FRICTION **12 Hrs**

Static and Dynamic Friction – Laws of friction - Equilibrium of a body on a rough Horizontal plane, inclined Plane and inclined plane subjected to a force acting along the inclined plane - Applications of friction - Simple contact friction (Ladder friction) – Screw friction – weight lifted by screw jack - Belt friction - Rolling Resistance.

UNIT IV: PROPERTIES OF SURFACES AND SOLIDS **12 Hrs**

Determination of Areas and Volumes-First moments of area and the Centroid of sections- Rectangle, circle, triangle from integration-T section, I section, Angle section, Hollow section using standard formula- Second and product moments of plane area- Rectangle, triangle, circle from integration-T section. I section, Angle section, Hollow section by using standard formula parallel axis theorem and perpendicular axis theorem- Mass moment of Inertia.

UNIT V: DYNAMICS OF PARTICLES AND RIGID BODIES **12 Hrs**

Dynamics of Particles - Displacement, velocity and acceleration, their relationship – Relative motion- Curvilinear motion – Newton‘s law – work-energy equation of particles - Impulse and Momentum – Law of conservation of momentum – D‘Alembert‘s Principle – Types of collision - Collision of Elastic Bodies – Newton‘s law of collision of bodies - co-efficient of restitution. Dynamics of Rigid Bodies – General plane motion – Velocity and Acceleration – Absolute and relative motion method – Equilibrium of Rigid bodies in Plane motion.

TOTAL : 60 Hours

TEXT BOOKS:

1. K.V. Natarajan, “Engineering Mechanics”, Dhanalakshmi publications, Revised Edition, 2008.
2. R.S Khurmi, ―A Textbook of Engineering Mechanics, S. Chand Publishers, 20th Revised Edition, 2014.

REFERENCES:

1. S.S. Bhavikatti, ―Engineering Mechanics, New Age International Publishers, 4th revised edition, 2012.
2. Palanichamy & Nagan, ―Engineering Mechanics Statics & Dynamics, Tata McGraw-Hill, Latest Edition, 2001.
3. S. Rajasekaran, G. Sankara Subramania, “Fundamentals of Engineering Mechanics”, Vikas Publishing House Pvt. Ltd., 2006.
4. Beer, F.P and Johnson Jr. E.R, ―Vector Mechanics for Engineers, Vol.1 Statics and Vol.2. Dynamics, TataMcGraw-Hill International Edition, 2001.

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)					
Course Code UBMCC11	Course Name Thermodynamics		**L** 3	**T** 0	**P** 0	**C** 3
Year and Semester	I Year & II Semester		Contact Hours Per Week 3Hrs			
Prerequisite course	Nil					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
		√				

Course Objectives	1. This course provides basic knowledge about thermodynamics and relation and their application to various processes.
Course Outcomes	The Students will be able to 1. Understand thermodynamics laws and their application 2. To understand concept of entropy and availability 3. Know about the properties of steam and their uses of steam table and mouier chart 4. Understand thermodynamics relation 5. Understand about psychometric chart

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	-	-	-	2	-	-	-	2	2	-
CO2	2	2	3	2	-	-	-	-	1	2	-	2	3	1	2
CO3	2	2	2	2	1	-	-	-	2	2	2	2	2	2	2
CO4	2	2	2	2	1	-	-	-	1	2	-	1	3	1	2
CO5	2	2	2	2	2	-	-	-	3	1	3	3	3	2	2
CO6	2	2	3	2	3	-	-	-	2	3	3	3	3	1	2
AVERAGE	2	2	2.3	1.8	1.8	-	-	-	1.8	2	2.7	2.2	2.7	1.5	1.7
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT – I : BASIC CONCEPTS AND FIRST LAW **9 Hrs**

Basic concepts - concept of continuum, comparison of microscopic and macroscopic Approach.Path and point functions. - Intensive and extensive, total and specific quantities. - System and their types.Thermodynamic Equilibrium State, path and process -Quasi-static, reversible and irreversibleprocesses. - Heat and work transfer, definition and comparison, sign convention - Displacement work and other modes of work - pv diagram.Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales.First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes

UNIT II:SECOND LAW AND AVAILABILITY ANALYSIS **9 Hrs**

Heat Reservoir, source and sink.-Heat Engine, Refrigerator, Heat pump. -Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. -Clausius inequality. - Concept of entropy, t-s diagram, Tds Equations, entropy change for - pure substance, ideal gases – different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

UNIT III :PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE **9 Hrs**

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface.Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances.Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economizer, preheater, Binary and Combined cycles.

UNIT IV :IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS **9 Hrs**

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reducedproperties-Compressibility factor-.Principle of Corresponding states.Generalized

Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

UNIT V: GAS MIXTURE AND PSYCHROMETRY **9 Hrs**

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function.Psychometric properties, Psychometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

TOTAL : 45 Hours

TEXT BOOKS:

1. Nag.P.K., ―Engineering Thermodynamics‖, 4thEdition, Tata McGraw-Hill, New Delhi, 2008.
2. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 7th Edition, TataMcGraw Hill, 2010

REFERENCE BOOKS:

1. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", AnuragamPublications, 2012
2. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill
3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice-Hall of India Pvt. Ltd
4. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2010
5. Arora C.P, ―Thermodynamics‖, Tata McGraw-Hill, New Delhi, 2003

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)					
Course Code	Course Name:		**L**	**T**	**P**	**C**
UBPHCPA	Engineering Physics Laboratory		0	0	2	1
Year / Semester	I Year & II Semester		Contact hours per week			
Prerequisite course	Nil		2 Hrs			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	

	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
	√			

Course Objective	1. Students should obtain the skill to design experiments to demonstrate various concepts of physics for determination of properties of materials
Course Outcome	After the successful completion of the course, the students will be able to: 1. Explain the calibration of Voltmeter and Potentiometer 2. Demonstrate the principles of light through convex lens and calculating its wavelength 3. Determine the surface tension and co-efficient of viscosity of water 4. Infer modulus of elasticity of torsion pendulum and Young's modulus of elasticity of a bar 5. Illustrate how to measure the thickness of the wire 6. Explain the concepts behind measurement of magnetic field along the axis of a coil

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	-	-	-	1	2	-	2	2	2	3
CO2	2	-	2	2	2	-	-	-	2	1	-	2	2	3	3
CO3	2	2	3	3	1	-	-	-	2	2	-	-	2	-	-
CO4	3	2	2	3	2	-	-	-	2	2	-	2	2	2	2
CO5	3	2	2	2	3	-	-	-	2	3	-	2	2	3	2
CO6	3	3	3	3	3	-	-	-	3	2	-	3	2	3	2
AVERAGE	2.50	2.20	2.33	2.50	2.00	-	-	-	2.00	2.00	-	2.20	2.00	2.60	2.40
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

LIST OF EXPERIMENTS

1. Calibration of low range voltmeter - potentiometer
2. Torsion pendulum – Rigidity modulus of elasticity
3. Spectrometer- Grating - wavelength of mercury spectral lines
4. Newton`s rings – Radius of curvature of a convex lens
5. Air wedge – Thickness of a wire
6. Surface tension of water -Capillary rise method
7. Uniform bending – Young's modulus of elasticity of a bar
8. Coefficient of viscosity of water – graduated burette
9. Non uniform bending -Young's modulus of elasticity of a bar
10. Field along the axis of a coil

Total : 30 Hours

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)

Course Code	Course Name:	L	T	P	C
UBEECPA	Basics of Electrical and Electronics Engineering Laboratory	0	0	2	1
Year and Semester	I Year & II Semester	Contact hours per week			
Prerequisite course	Nil	2 Hrs			

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
		√		

Course Objective	1. To acquire knowledge with an adequate work experience in the measurement of different quantities. 2. Expertise in handling the instruments involved.
Course Outcome	After the successful completion of the course, the students will be able to: 1. Demonstrate instruments such as ammeter and voltmeter for measuring resistance, power and power factor 2. Compare the vector diagrams of series and parallel R,L and C circuits 3. Explain how to measure power input to three phase induction motor using watt meters 4. Illustrate the characteristics of PN diode, Zener diode and JFET 5. Contrast the working principle of half wave and full wave rectifier using CRO 6. Combine measuring instruments for different parameters in engineering applications

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	-	2	-	-	-	2	2	-
CO2	2	2	3	2	-	-	-	-	2	2	-	2	3	2	2
CO3	2	2	2	2	2	-	-	-	2	2	2	2	2	2	2
CO4	2	2	2	2	1	-	-	-	1	2	-	1	3	2	2
CO5	2	2	2	2	2	-	-	-	3	1	3	3	3	2	2
CO6	2	2	3	2	3	-	-	-	2	3	3	3	3	2	2
AVERAGE	2.00	2.00	2.33	2.00	2.00	-	-	-	2.00	2.00	2.67	2.20	2.67	2.00	2.00
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

List of Experiments

1. Measurement of 'Low and High' resistances by Voltmeter and Ammeter method.
2. Obtain the current and voltage distribution in A.C. 'R-L-C' series circuits and draw the vector diagrams.
3. Obtain the current and voltage distribution in AC ‘R.L.C’ parallel circuits and draws the vector diagrams.
4. Measure the power and power factor of a single-phase load by 3 voltmeter method & ammeter method.
5. Measure the power input to 3-phase induction motor using two watt meters.
6. Characteristics of PN Junction Diode.
7. Characteristics of Zener Diode
8. Characteristics of JFET
9. Study of Half wave and Full wave Rectifiers
10. Study of CRO and LISSAJOUS pattern

TOTAL: 30 Hours

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)				
Course Code UBWSCPA	Course Name Engineering Practice Laboratory-I	**L** 0	**T** 0	**P** 4	**C** 2
Year and Semester	I Year & II Semester	Contact Hours Per Week 4 Hrs			
Prerequisite course	Nil				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
		√			

Course Objectives	1. To provide exposure to the students with hands on experience on machining, electric arc welding oxy – acetylene welding and fitting
Course Outcomes	The Students will be able to 1. Outline the operation of lathes and drilling machines. 2. Make use of welding equipments to join the structures. 3. Create simple components using lathe and drilling machine 4. Develop the Process of chipping, filling, hack sawing, drilling, tapping 5. Plan assembling and dismantling of components 6. Construct simple lap, butt and tee joints using arc welding equipments

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	2	2	2	-	1	-	-	-
CO2	-	-	-	-	-	2	1	2	2	3	-	-	-	-	-
CO3	-	-	-	-	-	2	1	2	1	2	-	1	-	-	-
CO4	-	-	-	-	-	2	2	3	2	3	-	2	-	-	-
CO5	-	-	-	-	-	3	2	1	3	2	-	2	-	-	-
CO6	-	-	-	-	-	2	1	2	3	3	-	2	-	-	-
AVERAGE	-	-	-	-	-	2.2	1.5	2	2.2	2.5	-	1.6	-	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

MACHINING:

Introduction and familiarization of operation of laths, drilling machines, shaping, milling and grinding machines - Safety- personal, tools, machines and environmental - Measuring tools and methods of measurement, reading of sketches and drawing, cutting tools, tool geometry - setting of tools methods of fixing of jobs on chucks, vices, jigs and fixtures - Speeds and feeds of machines - Operations of machines - Practical exercises on machines to develop and improve hands on skills.

FITTING:

Introduction and familiarization of various hand tools- Measuring, marking, cutting, holding and assembly tools, materials, parts, uses and safety of tools and personal safety - Process and procedures for measuring, Understanding of sketches and drawing - Marking and job holding methods - Process

of chipping, filling, hack sawing, drilling, tapping, dieying, assembling and dismantling of components - Practical exercises to develop and improve hands on skills.

ELECRIC ARC WELDING

Introduction, familiarization of different types of welding machines- welding Transformer, functions, tools, and equipment and environmental - Basic procedures of striking the arc - different methods of joining metals- different welding joints in different positions - welding defects - testing of welding joints - Practical exercises of welding of different thickness of metals in different positions to develop and improve hands on skills.

OXY – ACETELENE WELDING

Introduction – familiarization of tools and equipments - Gas cylinders, regulators, hoses and gas welding and gas cutting blow pipes - DS Processors - Procedures for setting up the equipments - Checking for leakage of gases, setting of jobs filler rods, flux, flame setting and controls of flame safety - personal safety protection, safety of cylinders, tool equipments and environmental safety-Procedures for gas welding, brazing and gas cutting - Different methods of joints in different positions and defects of joints, testing of joints - Practical exercises to develop and improve hands on skill of gas welding, brazing and gas cutting.

TOTAL: 60 Hours

PROGRAM	B.E (Department Of Naval Architecture And Offshore Engineering)				
Course Code UBLECPC	Course Name: Soft skill –II	**L** 0	**T** 0	**P** 3	**C** 2
Year and Semester	I Year & II Semester	Contact hours per week 3 Hrs			
Prerequisite course	-				

Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
	√			
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**

Course Objective	1. To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions, seek clarifications. 2. To help learners develop their speaking skills and speak fluently in real contexts. 3. Address the interview confidently 4. Making them realize the importance of English as Global language and its importance in today‘s scenario.
Course Outcome	After the successful completion of the course, the students will be able to: 1. Apply Articles, Prepositions, Pronouns, Adjectives and Adverbs in their speaking and writing skills 2. Infer the knowledge on public speaking and conduct of meetings 3. Develop skills on interactive English 4. Develop listening and speaking skills for effective presentation 5. Develop good attitude , behaviour and communication skills 6. Build interview skills and personality development

PPOs / COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	-	-	-	2	2	2	2	2	-	-	-	-	-
CO2	-	-	-	-	-	3	2	2	2	3	-	-	-	-	-
CO3	-	-	-	-	-	3	1	2	2	2	-	2	-	-	-
CO4	-	-	-	-	-	2	2	3	2	3	-	2	-	-	-
CO5	-	-	-	-	-	3	2	1	3	2	-	2	-	-	-
CO6	-	-	-	-	-	2	3	2	3	3	-	2	-	-	-

AVERAGE	-	-	-	-	-	2.50	2.00	2.00	2.33	2.50	-	2.00	-	-	-

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT 1: GRAMMAR AND FOUNDATON 14 Hrs

Training the students on second phase of grammar such as Articles, Prepositions, Pronouns, Modal Auxiliaries, Parts of Speech, Adjectives and Adverbs .

UNIT II: INTRO TO PROFESSIONAL ETHICHS 8 hrs

Stepping the students to advanced learning resource and introducing them about International standards How to conduct meetings, huddle, public speaking, free speech. Dress code.

UNIT III: INTERACTIVE ENGLISH 10 Hrs

The main objective is English for International communication. It course contains conversations, snapshots, readings, activities, a greater variety and amount of listening materials and more visuals to introduce vocabulary, more opportunities to build fluency, and up-to-date art and design.

UNIT IV: LISTENING AND SPEAKING 14 Hrs

Types of Listening –Introduction to International Standards of listening skills. Presentation skills: delivery (emphasis and phrasing) / making it interesting / body language / referring to visual aids

UNIT V: INTERVIEW SKILLS AND PERSONALITY DEVELOPMENT 14Hrs

Familiarize the students with types of Interviews such as mock interviews , campus Interview, Skype interview, telephonic Interview, Panel Interview,

TOTAL: 45 Hours

TEXT BOOKS:

1. Essential Grammar in use- Raymond Murphy ,Cambridge , New Third Edition

REFERENCE BOOKS:

1. New Interchange (English for International Communication) Jack C. Richards

SEMESTER III

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UBMTC03	ENGINEERING MATHEMATICS III	L	T	P	C
		3	1	0	4
Year and Semester	II Year (III Semester)	Contact hours per week (4Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
	✓				
Course Objective	1. To introduce Fourier series analysis this is central to many applications in engineering apart from its use in solving boundary value problems. 2. To acquaint the student with Fourier transform techniques used in wide variety of situations. 3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.				
Course Outcome	After completion of the course, the students will be able to: 1. Define the mathematical principles on transforms and partial differential equations. 2. Interpret Fourier series and coefficients 3. Formulate Fourier series and solve some of the physical problems of Engineering 4. Describe Fourier transform and its properties 5. Explain standard Z-transforms and its applications 6. Apply the mathematical principles in the engineering problems.				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	-	-	-	2	1	1	2	2	-
CO2	1	1	-	-	1	2	2	2	-	1	2	2	3	2	1

CO3	3	3	3	2	2	1	-	-	-	1	1	1	3	3	2
CO4	3	3	-	0	2	2	1	-	-	0	0	1	1	0	2
CO5	3	3	-	-	2	-	-	1	-	1	0	1	0	2	2
CO6	3	3	2	0	2	-	1	0	-	1	2	1	1	2	2
AVERAGE	2.3	2.3	2.0	0.8	1.7	1.5	1.3	1.0	0.0	1.0	1.0	1.2	1.7	1.8	1.8

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - PARTIAL DIFFERENTIAL EQUATIONS PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equation – Solution of PDE by direct Integration- Solution of equation $Pp + Qq = R$- Nonlinear equations of First order – Four types -

$f(p,q) = 0$, $f(z, p,q) = 0$, $f(x, p) = f(y,q)$ *and* $z = xp + yq + f(p,q)$

UNIT II - FOURIER SERIES

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 function in it domain

UNIT III - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges)

UNIT IV - FOURIER TRANSFORMS

Definition-Fourier Integral Theorem-Fourier Transform-Properties of Fourier transform (Without proof)-Convolution-Relation between Fourier and Laplace transforms.

UNIT V - Z - TRANSFORMS

Definition- standard Z-transforms- Standard results- properties of Z- transform (Without proof)- Initial value and Final value theorem- Inverse Z-transform –Convolution theorem-Convergence- Evaluation of Z-transform

Total : 60 Hours

TEXT BOOKS

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.

2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.

3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S. Viswanathan Publishers Pvt Ltd. 1998

REFERENCES

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd , 2007.

2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, NewDelhi, 2008.

3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.

4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.

5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013

Designed by	" Department of Naval Architecture & Offshore Engineering"

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code

UCNA301</td><td rowspan="2">FUNDAMENTALS OF NAVAL ARCHITECTURE</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Year and Semester</td><td colspan="2">II Year (III Semester)</td><td colspan="3" rowspan="2">Contact hours per week

(4Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="5">1. Gaining knowledge on various types of ships and shipyard process and to
2. obtaining a good knowledge on ship offset compilation and generation of Lines plan</td></tr>
<tr><td>Course Outcome</td><td colspan="5">After completion of the course, the students will be able to:

1. Distinguish the Different types of ships and its rules.
2. Understand the various definitions and the terms used in naval architecture and ship building
3. Illustrate Lines plan – fairing process- table of offsets, Views of lines plan, stem and stern profiles
4. Understand ship shapes of different kinds of ship and their floating behavior in floating condition.
5. Understand stability of ships at small and large angles.
6. At the end of the program the aim of this course is to define ship shape of particular ship and complete hydrostatic behavior including stability and trim of the ship under given floating condition</td></tr>
</table>

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	1	2	2	2	-	1	2	2	3	2	1

CO2	1	1	1	1	1	1	-	-	-	2	1	1	2	2	-
CO3	3	3	3	2	2	1	-	-	-	1	1	1	3	3	2
CO4	2	2	1	1	1	-	1	-	1	2	2	0	2	3	1
CO5	3	3	3	2	1	-	-	-	1	2	2	2	2	3	2
CO6	3	2	2	2	3	-	1	2	1	3	3	2	2	3	2
AVERAGE	2.2	2.0	2.0	1.6	1.5	1.3	1.3	2.0	1.0	1.8	1.8	1.3	2.3	2.7	1.6
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – SHIP TYPES AND THEIR TERMINOLOGY

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

UNIT II - GENERAL ARRANGEMENT FOR DIFFERENT VESSELS

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

UNIT III - LINES PLAN AND INTEGRATION RULES

Lines plan – fairing process- table of offsets, Views of lines plan, stem and stern profiles, Forms of coefficients, 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

UNIT IV - HYDROSTATIC CALCULATIONS

Calculations of areas, volumes, centroids, moment of inertia and second moment of inertia and other hydrostatic parameters

UNIT V - SECTIONAL AREA AND BONJEAN CURVES

Freeboard and load line regulation, Bonjean Curves, Sectional Area Curve, Cutting and Mould Loft

Total : 60 Hours

TEXT BOOKS

1. Lewis, E.U.; "Principles of Naval Architecture", (2nd Rev.), SNAME, New Jersey, U.S.A.

2. Rawson & Tupper; Basic Ship Theory.

REFERENCES

1. Tupper, E.C.: Introduction to Naval Architecture, Butterworth- Heinemann, UK, 1998. 2. Ship construction by DJ Eyres	
Designed by	" Department of Naval Architecture & Offshore Engineering"

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
UBMCC09</td><td colspan="2">STRENGTH OF MATERIALS</td><td>L
3</td><td>T
0</td><td>P
0</td><td>C
3</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td>Year and Semester</td><td colspan="2">II Year (III Semester)</td><td colspan="4" rowspan="2">Contact hours per week
(3Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td>✓</td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1.Gaining knowledge on simple stress and strain
2.Designing a block based on stress and strain
3.Design a cylinder, column and beam</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After completion of the course, the students will be able to:
1. Define stress, strain and its types are and how to find stress and strain for various sections.
2. Describe the principal stress and strain and its application in 2D & 3D.
3. Reproduce shear force, bending moment and how to draw shear force diagram & bending moment diagram for various types of beam and loads
4. Solve bending equation, shear stress equation and find bending stress & shear stress in a beam
5. Define a thin cylinder, columns and find the thickness of cylinder & bucking load for columns</td></tr>
</table>

		6. Analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behaviour of materials.													
POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	1	2	1	1	-	2	0	0	0	1	0
CO2	3	3	0	0	1	1	0	-	-	3	0	0	1	2	2
CO3	3	3	1		-	2	1	-	2	0	0	0	1	2	3
CO4	3	3	2	0	2	1	2	1	0	0	0	-	2	3	3
CO5	2	2	-	0	1	1	1	1	0	1	0	0	2	2	2
CO6	3	3	3	3	3	1	1	2	2	2	1	0	2	3	3
AVERAGE	2.8	2.8	1.5	0.8	1.6	1.3	1.0	1.3	1.0	1.3	0.2	0.0	1.3	2.2	2.2
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1 - STRESS AND STRAIN

Rigid bodies and deformable bodies – Tension, compression and shear stresses, Hooke's law, Modulus of Elasticity, Deformation of simple and compound bars - Stress and strain in bars with varying sections- taper section. Temperature stresses, Factor of safety, Elastic constant – Volumetric strain, Relationship between three elastic constants.

UNIT 2 - PRINCIPAL STRESSES AND STRAINS

Stress on an oblique section, General two dimensional stress system, Principal planes and principal stresses, Strain on an oblique section, Determination of principal strains Principal strain in three dimensions. Principal stresses determined from principal strains, Mohr's Circle for stress and strain.

UNIT 3 - SHEAR FORCE AND BENDING MOMENT

Beam – Types of beams, Loads – types of loads. Shear force, bending moment, Sign conventions, shear force and bending moment diagrams for cantilever, simply supported and over hanging with different loads, point of contra flexure, Maximum bending stress

UNIT 4 - BENDING AND SHEAR STRESSES IN BEAMS

Theory of simple bending, bending stress, neutral axis, Relation between bending stress and radius of curvature, relation between bending moment and radius of curvature, bending stress in symmetric section, bending stress in unsymmetrical section. Shear stress- shear stress at a section in a loaded beam, distribution of shear stress for various sections

UNIT 5 - TORSION

Strength and stiffness of solid or hollow shafts. Stress due to torsion. Power transmitted by shafts and Coupling bolts. Torsion applied to stepped shafts, compound shafts and partial hollow shafts, Torsion Applied to closely coiled springs, Plastic yielding of materials in torsion. Springs with axial load, Calculations for mean diameter of springs, wire diameter & number of coils. Close coiled helical spring.

Total : 45 Hours

TEXT BOOKS

1. Strength of Materials by Dr.R.K.Bansal

REFERENCES

1. Strength of Materials by Dr. S. Ramamrutham
2. Strength of Materials by R.S.Khurmi
3. Strength of materials by S.Senthil

1.

Designed by	" Department of Mechanical Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UBMCC04	FLUID MECHANICS	L	T	P	C
		3	0	0	3
Year and Semester	II Year (III Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
		✓			
Course Objective	1.Knowing the properties and characteristics of fluids 2. Understanding ans analyzing the performance of pumps and turbines.				
Course Outcome	After completion of the course, the students will be able to: 1. Interpret various properties of fluids and governing equations for fluid flow. 2. Identify types of flow and boundary layer concepts will be learnt. In addition, students will be able to analyze the flow through pipes. 3. Define the metacentric height and condition of equilibrium will be learnt 4. Identify various types of pumps along with their applications and analyze the flow through pumps. 5. Judge the performance and efficiencies of different types of turbines will be learnt. 6. Apply principles of fluid mechanics to the operation, design, and selection of fluid machinery such as pumps, blowers, fans, compressors, and turbines				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	2	1	2	1	3	1	-	-	1	2	2

CO2	2	2	-	3	2	2	-	1	3	2	-	-	1	-	-
CO3	2	2	-	-	3	-	-	1	3	2	-	-	1	3	3
CO4	-	-	2	3	3	-	-	-	3	2	-	-	2	2	2
CO5	-	3	-	-	1	-	-	1	3	2	-	-	2	2	2
CO6	2	3	3	3	2	2	0	2	3	3	-	2	2	3	3
AVERAGE	2.3	2.6	2.5	3.0	2.2	1.7	1.0	1.2	3.0	2.0	0.0	2.0	1.5	2.4	2.4
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1 - FLUID PROPERTIES AND FLOW CHARACTERISTICS

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation - Equation of motion – Eulers' equation of motion – Bernoulli's equation. - Momentum equation

UNIT 2 - FLOW THROUGH CIRCULAR CONDUITS

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel

UNIT 3 - BUOYANCY AND FLOATATION

Buoyancy – center of Buoyancy – Metacentre – Metacentric height – Analytical method for determining meta centre – Condition for Equilibrium of a floating and sub-merged Bodies – experimental method of determination of Meta centric height

UNIT 4 - PUMPS

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves – Reciprocating pump working principle – Rotary pumps –classification.

UNIT 5 - TURBINES

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

Total : 45 Hours

TEXT BOOKS

1 Dr. R.K.Bansal " A text book of Fluid Mechanics and Hydrulic Machines ", Laxmi Publications.

2 Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

REFERENCES

1.K. L., "Engineering Fluid Mechanics", Eurasia Publishing House (p) Ltd., New Delhi2004

2. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011

Designed by	" Department of Mechanical Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UBEE308	PRINCIPLES OF MARINE ELECTRICAL TECHNOLOGY	L	T	P	C
		3	0	0	3

Year and Semester	II Year (III Semester)	Contact hours per week (3Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
		✓		

Course Objective	1. Imparting knowledge about Ac Motors and Ac Motor Starters,Ac Machines 2. Knowing about Marine Switch Boards, Neutral System, Emergency Supply And Insulation Resistance 3. Understanding the Dc Machines & Lighting Systems In Ship 4. Knowing the Electrical Installations & Safety And Instrumentation
Course Outcome	After completion of the course, the students will be able to: 1. Explain the principle Of Operation Ac Motors and Ac Motor Starters 2. Use Ac & Dc Generators and Obtain Its Characteristics. 3. Operate Switch Boards, Lighting Systems And Measuring Devices. 4. Practice the Operation and Maintenance of Commonly Used Batteries, generators On Board Ship 5. Infer Hazards Of Live Electrical Systems And Safe Electrical Practice 6. Practice engineering pertaining to marine and facilities power systems and associated auxiliary systems (e.g. propulsion, electrical power generation and distribution) in support of the maritime sector.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	3	-	-	1	3	2	-	-	2	3	-
CO2	3	3	-	-	3	2	-	1	3	2	-	-	3	2	1

CO3	3	3	-	-	2	3	2	2	3	3	-	-	-	3	-
CO4	3	3	-	-	3	3	-	2	3	3	-	-	1	3	-
CO5	3	3	-	-	3	3	-	3	2	2	-	-	-	3	-
CO6	3	3	-	-	3	2	2	3	2	2	-	-	1	3	2
AVERAGE	3.0	3.0	0.0	0.0	2.8	2.6	2.0	2.0	2.7	2.3	0.0	0.0	1.8	2.8	1.5
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1 - AC MOTORS & AC MOTOR STARTERS

Understand The Principle Of Operation Of A Direct On Line Starter (Dol) Starter, Star Delta Starter, Auto transformer Starter, Understand The Need And Means For Motor Protection. 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

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 & EMERGENCY SUPPLIES

Understand The Function Of The Main Switchboard, Need And Methods Ac System Protection. Understand The Types Of Neutral Systems And Earth Fault, The Operation And Maintenance of Commonly Used Batteries On Board Ship, Operation Of The Emergency Generator. Understand Insulation Resistance Measurement.

UNIT IV- DC MACHINES & SHIP LIGHTING SYSTEM

Understand The Construction And Principle Of Operation Of A Dc Generator And Dc Motor. Understand Different Types Of Lightings Installed on-board Ships. Understand Principle Of 3 Phase Alternating Voltage Generation.

UNIT V - ELECTRICAL INSTALLATIONS & SAFETY AND INSTRUMENTATION

Understand Hazards Of Live Electrical Systems And Safe Electrical Practice. Fuse Protection, General Maintenance. Temperature, Pressure, Torque, Rpm Measuring Devices – Methods Working Principles

Total : 45 Hours

TEXT BOOKS

1. Practical Marine Electrical By. Dennis T. Hall, Witherbys Seamanship Ltd, 1999.
2. Marine Electrical Technology 2nd Edition By. Elstan A. Fernandez, Shroff Publishers, 2013.

Designed by	" Department of Electrical Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	MATERIAL SCIENCE	L	T	P	C
UBMCC06		2	0	0	2

Year and Semester	II Year (III Semester)	Contact hours per week
Prerequisite course	NIL	(2Hrs)

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
		✓		

Course Objective	Gaining knowledge about various materials used in production of engineering applications
Course Outcome	After completion of the course, the students will be able to: 1. Select the materials and their alloys phases through phase diagram. 2. Understand the various heat treatment methods applied on materials 3. Determine the various properties of engineering materials 4. Interpret the behavior of materials under force and their testing methods 5. Identify the mechanism of corrosion and factors influencing corrosion 6. Understand the basic aspects of advanced engineering materials and their applications in marine industry

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	-	-	3	-	-	2	3	2	-	-	-	1	1
CO2	1	1	-	-	3	1	2	3	3	2	-	-	-	1	-
CO3	3	3	-	-	3	2	2	2	3	3	-	-	1	2	2
CO4	3	3	-	-	3	2	2	3	3	3	-	-	2	3	2

CO5	-	3	-	-	3	3	3	0	3	2	-	2	3	3	3
CO6	3	3	-	-	3	3	3	2	3	3	-	3	3	3	3
AVERAGE	2.5	2.7	0.0	0.0	3.0	2.2	2.4	2.0	3.0	2.5	0.0	2.5	2.3	2.2	2.2
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1 - MATERIALS SCIENCE AND ENGINEERING

Introduction, Developments in materials, engineering profession and materials, Classification of materials, criteria for selection of materials for the required application, ferrous materials: Cast iron, Steel, Stainless Steel, Prominent alloy steel. Non-Ferrous materials: Copper, Brass, Bronze, Aluminium, Lead, Tin, Titanium. Materials for High and Low temperature service, classification of heat resistant materials

UNIT 2 - PROPERTIES OF MATERIALS

Mechanical Properties: Hardness, Strength, Toughness, Stiffness, Ductility, Malleability, Harden ability, creep and fatigue Electrical properties: Conduction, Semiconductors and insulators Optical properties: Absorption, Reflection, Transmission and Refraction optical fibres and lasers. Magnetic properties: Various types of magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Ferrites, hard and soft magnetic materials Thermal properties: Thermal expansion, Heat capacity, Thermal conduction, Thermal Stresses.

UNIT 3 - HEAT TREATMENT

Heat treatment - Annealing, Normalizing, Hardening, Tempering Case Hardening – Carburizing, Nitriding, Cyaniding and carbon nitriding, Flame hardening, Induction Hardening

UNIT 4 - MATERIAL TESTING

Study of fractures of engineering materials - Elastic deformation, Plastic deformation, Stress- Strain diagrams; Properties obtained from the tensile test Destructive testing - Tensile testing, compression testing, Impact Testing, Hardness test, Jominy end quench test for harden ability of steel. Non-destructive testing – Visual Inspection, Hammer test, Radiography, Magnetic particle inspection, Liquid Dye penetration test, Ultrasonic inspection test

UNIT 5 - MATERIALS ENVIRONMENT INTERACTIONS

Principles of corrosion, factors influencing corrosion, Basic Mechanism of corrosion, Electro-chemical corrosion, direct dissolution mechanisms, Dry and wet corrosion, galvanic corrosion. Methods of corrosion control, cathodic and anodic protection, corrosion inhibitors. Surface coatings, corrosion monitoring.

Total : 30 Hours

TEXT BOOKS

1 Callister william D.Jr, “Material Science and Engineering an Introduction”, John Wiley & sons inc.

2 O.P.Khanna, “Material Science and Metallurgy”, Dhanpat Rai Publications, 2014 edition.

REFERENCES

1 Schaeffer J.P: Saxena A, Antolovich S.D, Sanders T.H. Jr., Warner S.B., “The Science & Design of Engineering Materials”, McGraw-Hill International

2 Askeland Donald R. and Phule P.P., “The science and engineering materials”, Thomson learning.

Designed by	“ Department of Mechanical Engineering”

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA3PA	SHIP DESIGN CALCULATION DRAWING & DRAFTING - I (SDCADD - I)	L	T	P	C
		0	0	4	2

Year and Semester	II Year (III Semester)	Contact hours per week (4Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. To gain the knowledge on offset tables and ship lines plan 2. To learn converting the manual drawing to AutoCAD.
Course Outcome	After completion of the course, the students will be able to: 1. Identify the offset table from BSRA series 2. Recognize basic commands in AutoCAD 3. Sketch stem and stern profile 4. Construct the complete lines plan of the given vessel manually and CAD 5. Find the faired sets of lines plan at the end. 6. Sketch complete lines plan of any vessel both manually and in software.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	-	2	3	2	1	2	3	3	3
CO2	3	3	3	3	3	1	-	1	3	2	1	1	1	3	3
CO3	2	2	2	2	2	-	1	2	1	2	1	-	3	3	3
CO4	3	3	3	3	2	1	1	1	1	1	1	1	3	3	3

CO5	3	3	3	3	3	2	1	1	1	1	1	1	3	3	3
CO6	3	3	3	3	3	2	1	1	1	1	1	1	3	3	3
AVERAGE	2.8	2.8	2.8	2.8	2.5	1.4	1.0	1.3	1.7	1.5	1.0	1.2	2.7	3.0	3.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

LIST OF ASSIGNMENTS

1.Selection of Main particulars based on Parent ship analysis

2.Generate the Offset table from the BSRA

3. Draw the lines plan of the given vessel manually

4. Develop the Offset table manually from the lines plan

5. Create the CAD drawing of lines plan using AUTOCAD

6. Prepare the faired offset table and the lines plan

Total : 30 Hours

TEXTBOOKS:

1. Robert Taggard, ship design & construction, The society of naval architecture & marine engineers,1980
2. Eric C.tupper, Introduction to naval architecture, reed Elsevier India pvt lmt,2010
3. Principles of naval architecture, vol I II & III.

REFERENCES:

1. Principles of Naval Architecture, vol I II & III.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	STRENGTH OF MATERIALS LABORATORY	L	T	P	C
UBMCCPG		0	0	2	1

Year and Semester	II Year (III Semester)	Contact hours per week (2Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
		✓		

Course Objective	Demonstrating practically what is hardness & strength of materials and how energy is absorbed in spring.
Course Outcome	After completion of the course, the students will be able to: 1. Operate the equipment's also know how to conduct the test on a machine and analyze the data obtained. 2. Determine toughness of metal 3. Estimate Hardness of metal 4. Test torsion on metal 5. Evaluate fatigue on mild steel 6. Determine the various physical properties of metals based on learned experiments.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	3	-	-	3	3	-	3	3	-	-
CO2	3	3	3	-	-	3	-	-	3	3	-	3	2	-	-
CO3	3	2	2	-	-	3	-	-	3	3	-	3	2	-	-

CO4	3	3	3	-	-	3	-	-	3	3	-	3	3	-	-
CO5	3	3	3	-	-	3	-	-	3	3	-	3	3	-	-
CO6	3	2	2	-	-	3	-	-	3	3	-	3	2	-	-
AVERAGE	3.0	2.7	2.7	0.0	0.0	3.0	0.0	0.0	3.0	3.0	0.0	3.0	2.5	0.0	0.0
CORRELATION LEVELS			1. SLIGHT(LOW)			2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)			

LIST OF EXPERIMENTS

1. Tension test and Compression test on a mild steel rod in a Universal Testing machine
2. Izod Impact test on metal specimen
3. Charpy Impact test on metal specimen
4. Hardness test on metals - Brinell
5. Hardness test on metals - Rockwell Hardness Number
6. Compression test on helical springs
7. Torsion test on mild steel rod
8. Fatigue test on mild steel
9. Compression test on a Concrete block

Total: 30 Hours

TEXT BOOKS

1 Callister william D.Jr, “Material Science and Engineering an Introduction”, John Wiley & sons inc.

2 O.P.Khanna, “Material Science and Metallurgy”, Dhanpat Rai Publications, 2014 edition.

REFERENCES

1 Schaeffer J.P: Saxena A, Antolovich S.D, Sanders T.H. Jr., Warner S.B., “The Science & Design of Engineering Materials”, McGraw-Hill International

2 Askeland Donald R. and Phule P.P., “The science and engineering materials”, Thomson learning.

Designed by	“ Department of Mechanical Engineering”

<table>
<tr><td>PROGRAM</td><td colspan="9">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UBLECPD</td><td colspan="3">Soft Skills-III</td><td>L</td><td>T</td><td colspan="2">P</td><td colspan="2">C</td></tr>
<tr><td></td><td colspan="3"></td><td>2</td><td>0</td><td colspan="2">3</td><td colspan="2">2</td></tr>
<tr><td colspan="10"></td></tr>
<tr><td>Year and Semester</td><td colspan="3">II Year (III Semester)</td><td colspan="5" rowspan="2">Contact hours per week

(3Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="3">NIL</td></tr>
<tr><td rowspan="3">Course category</td><td colspan="2">Humanities and Social Sciences</td><td colspan="2">Management courses</td><td colspan="2">Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td colspan="2">✓</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Basic Science</td><td colspan="2">Engineering Science</td><td colspan="2">Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="9">1. Making students to learn the advanced English
2. Raising up their confidence level
3. Making them aware of the coorporate world and the expectations
4. Preparing them for campus Interview</td></tr>
<tr><td>Course Outcome</td><td colspan="9">After completion of the course, the students will be able to:

1. Constructivism : Conceptualizing the nuances of the tenses in situational usage
2. Learning Theory : Enhancing verbal and collaborating other communicative activities
3. Critical thinking: coordinating and building fluency in the individuals lexical
4. Cooperative learning : Interactive participation of the self with other individuals
5. Active Participation: to confidently step into and command situations with Clair.
6. Enhances the versatility of the students on all skills</td></tr>
</table>

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	-	-	-	-	-	-	-	2	3	2	3	-	1	1	1
CO2	-	-	-	-	-	-	-	3	3	2	3	-	1	1	1
CO3	-	-	-	-	-	-	-	2	3	3	3	-	1	2	1
CO4	-	-	-	-	-	-	-	3	3	3	3	-	2	2	1
CO5	-	-	-	-	-	-	-	-	3	2	3	-	2	2	1
CO6	-	-	-	-	-	-	-	2	3	3	3	-	2	2	1
AVERAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	3.0	2.5	3.0	0.0	1.5	1.7	1.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT1:GRAMMARANDFOUNDATON **10 Hrs**

Training the students on basic grammar and foundation and laying the standard platform. A complete standard syllabus of Cambridge is used. The main part of the 1st semester is to cover the major tenses (Present tense, Present Continuous, Past Tense, Past Continuous, Present Perfect, and Present Perfect continuous.

UNIT II: BODY LANGUAGE AND LEXICAL RESOURCE WITH BASIC WRITTEN SKILS 8hrs

Posture, eye contact, gestures with hands and arms, speech, tone of the voice

One word substitutes, E-mail communication, creating blogs, free writing on any given topic, writing definitions.

UNITIII:INTERACTIVEENGLISH **6 Hrs**

The main objective is English for International communication. It course contains conversations, snapshots, readings, activities, a greater variety and amount of listening materials and more visuals to introduce vocabulary, more opportunities to build fluency, and up-to-date art and design. The course covers the fours skills of listening, speaking, reading and writing, as well as improving pronunciation and building vocabulary.

UNITIV:LISTENINGANDSPEAKING **8 Hrs**

Types of Listening -Listening and note taking-Pronunciations-Stress and Intonation-Conversation technique-Dialogue Writing -Professional Communication-Interview-Group Discussion –Power point Presentation-Lab

UNITV: INTERVIEW SKILLS AND PERSONALITY DEVELOPMENT **8 Hrs**

Personality development – Self motivation, Self actualization, Stress management, Interview skills, Negotiation skills, familiarization and strategies of telephonic , skype, one on one, panel, exit interviews

Total: 45 Hours

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Essential Grammar in use- Raymond Murphy ,Cambridge , New Third Edition
2. Communication skills

REFERENCE BOOKS:

1. New Interchange (English for International Communication) Jack C. Richards

Designed by	"AMET CENTRE FOR IELTS"

SEMESTER: IV

<table>
<tr><td>PROGRAM</td><td colspan="6">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code

UBMTC04</td><td rowspan="2">PROBABILITY AND STATISTICS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td>Year and Semester</td><td colspan="2">II Year (IV Semester)</td><td colspan="4" rowspan="2">Contact hours per week

(4Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td>✓</td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1. Acquiring skills in handling situations involving more than one random variable and functions of random variables.
2. Introducing to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
3. Knowing the statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After completion of the course, the students will be able to:

1. Use statistical methods involving one and several random variables.
2. Define two dimensional random variables and distributions</td></tr>
</table>

	3. Analyze and identify the nature of sampling distributions which are much importance in management problems 4. Use statistical methods which are applied especially in the realm of scientific experiments and the testing of hypothesis 5. Infer Statistical quality control measures and attributes 6. Apply key concepts of probability and statistics in various engineering problems

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	2	-	-	1	3	2	-	-	1	-	-
CO2	2	2	-	-	2	2	-	1	3	2	-	-	-	-	-
CO3	3	3	-	1	1	-	2	3	2	3	3	2	2	-	-
CO4	3	3	-	3	-	2	1	3	3	2	3	-	-	-	1
CO5	2	2	-	-	3	3	-	2	2	2	3	-	-	-	-
CO6	3	3	-	-	3	3	-	2	3	2	3	1	1	-	2
AVERAGE	2.7	2.7	0.0	2.0	2.2	2.5	1.5	2.0	2.7	2.2	3.0	1.5	1.3	0.0	1.5

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - RANDOM VARIABLES

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 VARIABLES

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

UNIT III - TESTING OF HYPOTHESIS

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

UNIT IV - DESIGN OF EXPERIMENTS

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

UNIT V - STATISTICAL QUALITY CONTROL

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

Total : 60 Hours

TEXT BOOKS

1. J. S. Milton and J.C. Arnold, " Introduction to Probability and Statistics", Tata McGraw Hill, 4th edition, 2007. (For units 1 and 2)

2. Grewal. B.S, "Higher Engineering Mathematics", 40thEdition, Khanna Publications, Delhi, 2007

3. R.A. Johnson and C.B. Gupta, "Miller and Freund‟s Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, (2007)

REFERENCES

1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.

2. Navidi, W, "Statistics for Engineers and Scientists", Special Indian Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi,2008.

3. Spiegel, M.R, Schiller, J and Alu Srinivasan, R, "Schaum‟s Outlines Probability and Statistics", Tata McGraw-Hill Publishing Company Ltd. New Delhi ,2007

Designed by	" Department of Mathematics"

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code

UCNA401</td><td rowspan="2">STABILITY OF SHIPS - THEORY & CALCULATIONS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Year and Semester</td><td colspan="2">II Year (IV Semester)</td><td colspan="3" rowspan="2">Contact hours per week

(4Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="5">Understanding and evaluating the ship stability parameters in static, dynamical and damaged conditions</td></tr>
<tr><td>Course Outcome</td><td colspan="5">After completion of the course, the students will be able to:

1. Infer the different aspects related to Ship Stability
2. Judge effect of weights on Centre of gravity (by shifting, lifting, loading & unloading)
3. Evaluate ship stability in various loading conditions during the design life time of the ship
4. Find the stability of a vessel under a given damaged condition either by added weight method or by the lost buoyancy method
5. Perform the stability analysis of a ship (eg : M. V. HINDSHIP)</td></tr>
</table>

		6. The overall outcome of this course is to understand in totality the ship stability criteria under a given loading condition and sea state as required by SOLAS and other regulating authorities.													
POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	3	-	-	2	1	3	-	2	3	1	3
CO2	3	3	-	-	1	2	-	2	1	3	-	2	3	2	3
CO3	3	3	-	-	3	1	1	-	1	1	-	2	2	3	3
CO4	3	3	-	2	3	2	-	2	-	2	-	2	3	3	3
CO5	3	3	-	2	-	3	-	2	-	1	-	2	3	3	3
CO6	3	3	-	-	2	2	1	2	-	1	-	2	3	3	3
AVERAGE	2.8	2.8	0.0	2.0	2.4	2.0	1.0	2.0	1.0	1.8	0.0	2.0	2.8	2.5	3.0
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION TO SHIP STABILITY

Introduction to state of equilibrium; Stability of ships - Stable and Unstable and Neutral condition for floating and submerged body; Stability terms - Tonnes per centimetre (TPC), Fresh Water Allowance (FWA), Dock Water Allowance (DWA), Metacentre, Metacentric radius, Metacentric height, Metacentre curve, Righting moment and lever.

UNIT II - CARGO EFFECT ON STABILITY

Effect of weights on C.O.G (shifting, lifting, loading & unloading); Equivolume inclinations - shift of C.O.B. due to inclinations; Moments due to wind, shift of cargo, passengers, turning and non-symmetrical accumulation of ice; Effect of superstructure on stability

UNIT III - TRANSVERSE STABILITY

Initial stability GM, GZ at small angles of inclinations, wall sided ships; Free Surface effects, Effect of grain on Cargo; inclining experiment; MCH (Moment Changing Heel).

Large angle stability - Diagram of statically stability (GZ - curve), Characteristics of GZ - curve, static equilibrium criteria; Methods for calculating the GZ – curve, Cross curves of stability; Dynamical stability - diagram of Dynamical stability, Dynamical stability criteria. Stiff/ Tender ship, Wind and heeling effect, IMO criteria

UNIT IV - 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, ballasting, launching

Stability while docking and grounding

UNIT V - DAMAGE STABILITY

Damage stability - Deterministic and Probabilistic approach; Recommendations of classification societies and governmental authorities - Intact and damage stability rules, Bilging of compartment

Flooding calculation, Floodable length

Practical: Stability check of M. V. HINDSHIP – Trim and Stability Booklet and launching calculations

Total : 60 Hours

TEXT BOOKS

1. Edward V Lewis, Principle of Naval Architecture, Vol-1, III EDITION, The Society of Naval Architects and Marine Engineers, 1988

2. K. J. Rawson & E. C. Tupper, Basic Ship Theory, V Edition, Butterworth Heinmann, 2001

REFERENCES

1. E. C. Tupper, Introduction to Naval Architecture, III Edition, Butterworth Heinmann, 2002
2. C. B. Barrass and Captain D. R. Derrett, Ship Stability for Masters and Mates, Elsevier, 2006

Designed by	" Department of Naval Architecture & Offshore Engineering"

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code

UCNA402</td><td rowspan="2">THEORY OF STRUCTURES</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Year and Semester</td><td colspan="2">II Year (IV Semester)</td><td colspan="3" rowspan="2">Contact hours per week

(3Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="5">Knowing the various methods involved in analysing indeterminate structures, response evaluation and generation of stiffness matrix for various structural problems</td></tr>
<tr><td>Course Outcome</td><td colspan="5">After completion of the course, the students will be able to:

1. Draw the shear force and bending moment diagram for indeterminate structures as applicable to ship and offshore structures
2. Infer stiffness matrix for various structural problems which will be used various finite element analysis.
3. Estimate natural frequencies and system response under a given dynamic conditions
4. Study of single degree of freedom system , two degree of freedom system and multiple degree of freedom system which can be extended to continuous system such as ships</td></tr>
</table>

and large offshore structures under various loading conditions as imposed by regular and irregular seas .

5. Redesign a given structure based on the structural response criteria so that the functioning of various machineries and equipment including microprocessors and computers installed in a ship for smooth ship operation.
6. Design a floating structure (ship or offshore) for longer life cycles and hustle free operation for which the structure is designed .

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	1	2	-	-	2	2	-	1	3	3	3
CO2	3	3	-	-	3	2	-	2	1	-	-	2	2	3	2
CO3	3	3	-	-	3	3	-	2	2	1	-	2	2	3	3
CO4	3	3	-	-	2	3	1	2	-	2	-	2	3	3	3
CO5	2	3	1	-	1	3	2	3	-	1	-	3	3	3	3
CO6	3	3	2	-	3	3	3	2	-	-	-	2	2	3	2
AVERAGE	2.8	3.0	1.5	0.0	2.2	2.7	2.0	2.2	1.7	1.5	0.0	2.0	2.5	3.0	2.7

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT 1 - ANALYSIS FOR INDETERMINATE STRUCTURES - I

Determination of SFD and BMD for determinate structures, Continuous beams - Clapeyron's theorem or three-moment equation, Moment distribution Method, Torsion of non-circular sections

UNIT II - ANALYSIS FOR INDETERMINATE STRUCTURES - II

Strain energy method, principle of virtual work, flexibility method, stiffness method, strain energy and complementary energy, Castiglione's theorems and applications

UNIT III - SHEAR FLOW

Shear center of simple cross sections and shear flow calculation, Introduction of theory of plasticity

UNIT IV - DYNAMICS OF STRUCTURES

SDOF - Free, damped and forced vibration, Introduction to MDOF system, Continuous system evaluation of natural frequencies.

UNIT V - STIFFNESS MATRIX FORMULATION

Matrix methods - flexibility and stiffness matrices: transformation matrices and its applications.

Total : 45Hours

TEXT BOOKS

1. R.S. Khurmi; Theory of structures, S.Chand Publications.

2. Dr. B.C. Punmia: Theory of Structures, Laxmi Publications.

3. Reddy, C.S; Basic Structural Analysis, Tata-McGraw Hill Publications. Timoshenko & Young; Theory of plates, McGraw Hill Publications.

4. Krishna Raju&Gururaja; Advanced Mechanics of solids and structures, Narosa Publications

5. Mechanical vibrations by V P Singh

REFERENCE BOOKS

1. Roger and Reddy, Mechanics of solids and structures, CRC press, 2012.

2. Timoshenko; Strength of Materials, East-West Publications, 1965

3. Popov; Engineering Mechanics of Solids, Prentice-Hall Publications.

4. L.S.Sreenath, Advanced Mechanics of solids, Tata McGraw Hill, 2010

Designed by	" Department of Naval Architecture & Offshore Engineering"

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code

UCNA403</td><td rowspan="2">MARINE MATERIALS AND METAL JOINING TECHNIQUES</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Year and Semester</td><td colspan="2">II Year (IV Semester)</td><td colspan="3" rowspan="2">Contact hours per week

(3Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="5">Understanding the various material and welding techniques used in shipbuilding industry</td></tr>
<tr><td>Course Outcome</td><td colspan="5">After completion of the course, the students will be able to:

1. Choose the appropriate materials for design and construction of marine structures
2. Monitor Non destructive test method and able to interprets the results obtained from NDT methods
3. Identify different metal joining techniques
4. Practice different welding procedure
5. Find welding defects and Metallurgical problems during welding and asses the mechanical properties of the material.
6. Produce a structure which is free from locked- in stress due to various welding and cutting operations and also to relieve residual stresses and distortions due to construction related procedures by studying the various methods of welding and cutting technologies used in ship building</td></tr>
</table>

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	1	3	2	2	-	2	-	2	3	3	3
CO2	1	2	-	1	2	3	1	2	3	-	-	2	2	3	2
CO3	1	1	-	-	1	2	-	1	3	2	-	-	2	3	2
CO4	3	3	-	-	3	2	-	2	3	-	-	2	3	3	3
CO5	3	3	-	-	3	3	-	3	3	-	-	2	2	3	3
CO6	3	3	-	2	3	2	2	2	3	-	-	2	3	3	3
AVERAGE	2.3	2.2	0.0	1.5	2.2	2.5	1.7	2.0	3.0	2.0	0.0	2.0	2.5	3.0	2.7
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - MATERIALS FOR CONSTRUCTION

Introduction to Materials and their properties, Mechanical properties, application and advantages of Al alloy, Fe alloy, wood, FRP/GRP, low carbon steel, material for propeller, rudder, Anchor, Joining technique of Al to M.S, PVC, FRP/GRP, S.S to M.S, Introduction to pile foundation, Classification Society rules for Materials

UNIT II - INTRODUCTION TO WELDING

Introduction to joining technique, Drawback of Rivets, Welding - Classifications of welding, edge preparation, welding positions, types of arc welding – MMAW, SAW, TIG, MIG, PAW, advantages and disadvantages of arc welding, welding defects, Welding symbols, Weldability – definition, concept, purpose, Solid state welding process – Friction Stir Welding, Introduction to Gas welding, Laser beam welding, Combination of Laser and TIG/MIG welding

UNIT III - WELDING PROCEDURE

WPS – essential, sub-essential, non-essential variable for various weldings, P-no, A-no, F-no, various welding joints, sample WPS, notch toughness characteristics, PQR – Sample PQR, WPQT

UNIT IV - WELDING METALLURGY

Electrodes – types of electrodes, coatings, properties, Metallurgical problems of dissimilar metal welding, Welding Metallurgy – Introduction, HAZ, Welding arc, Heat flow, temperature

distribution, cooling rate, Metal Solidification – process and rate, Absorption of gases, Gas - metal reaction, Porosity.

UNIT V - DESTRUCTIVE AND NON-DESTRUCTIVE TESTING

Tensile Test – specimen preparation for transverse tensile test, All weld metal tensile test, test procedure, Bend Test – types of bend test – free bend, guided bend, transverse bent, Hardness test Non Destructive Test – Visual Inspection, Liquid Penetration Test, Radiographic Test – Introduction, principle, X-Ray radiography procedure, gamma ray, Magnetic Particle Test, Ultrasonic Test – principle, procedure, limitations, application, advantages.

Total : 45 Hours

TEXT BOOKS

1. George E Dieter – Mechanical Metallurgy, Mc GRAW HILL, edition 3

2. O.P.Khanna - A Textbook of Welding Technology, DhanpatRai & Sons.

REFERENCES

1. Richard Little - Welding and Welding Technology, McGraw Hill, (2001), 1st edition.
2. Welding handbook - American Welding Society, (1983), 7th edition, volume 1 & 2, USA

Designed by	" Department of Naval Architecture & Offshore Engineering"

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code

UCNA404</td><td rowspan="2">MARINE HYDRODYNAMICS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Year and Semester</td><td colspan="2">II Year (IV Semester)</td><td colspan="3" rowspan="2">Contact hours per week

(4Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="5">Obtaining a basic understanding of the fluid mechanics applicable for the ship and wave hydrodynamics</td></tr>
<tr><td>Course Outcome</td><td colspan="5">After completion of the course, the students will be able to:

1. Define flow characteristics around various floating shapes, further helps in evaluating the hydrodynamics related to ships and offshore structures.
2. Identify different components and estimation of forces on cylindrical and aerofoil sections
3. Explain concepts behind wave kinematics using linear wave theory and its application in Naval Architecture and Offshore Engineering
4. Analyze unsteady flow and its characteristics
5. Estimate force Exerted by a flowing fluid on structure under various conditions
6. Make use of various hydrodynamic governing laws and their usage to understand the boundary layer , wave propagation and wave energy</td></tr>
</table>

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	3	2	-	2	3	2	-	2	2	2	2
CO2	3	3	-	-	2	2	3	2	3	1	-	2	2	2	3
CO3	2	2	-	-	3	1	-	-	2	-	-	3	2	1	3
CO4	3	3	-	-	3	2	-	2	3	-	-	2	2	1	2
CO5	3	3	-	-	3	3	2	2	1	-	-	2	2	1	3
CO6	3	2	-	-	3	2	-	2	3	1	-	3	3	2	3
AVERAGE	2.5	2.5	0.0	0.0	2.8	2.0	2.5	2.0	2.5	1.3	0.0	2.3	2.2	1.5	2.7
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - FLUID KINEMATICS

Introduction, Types of fluid flow; Lagrangian and Eulerian methods of flow description, substantial derivative, streamlines, pathlines, vorticity; potential and stream function; Equation of continuity - Cartesian and Polar coordinates; Equation of motion – Euler's equation of motion – Bernoulli's equation and its practical applications – Bernoulli's equation from Euler's equation, Problems

UNIT II - IDEAL FLOW

Uniform flow, Source, Sink, Pressure distribution in a plane source flow, Principle of superposition, Doublets – stream function and velocity Potential - Source and Sink pair in uniform flow, doublet in uniform flow, Flow past a circular cylinder with and without circulation - Magnus effect – Flow over a streamlined body – Problems

UNIT III - VISCOUS FLOW AND BOUNDARY LAYER

Viscosity of fluids, Flow through a pipe of circular section, Poiseuille law, flow of fluid between parallel plates – Coutte's law, Navier stroke's equation of motion; Boundary layer, Reynolds Number; Boundary layer along a flat plate; Separation of Boundary Layer - Problems

UNIT IV - FORCES ON SUBMERGED BODIES

Force Exerted by a flowing fluid on a stationary body, drag, lift forces – expression, Drag on sphere, cylinder, development of lift on circular cylinder, Aerofoils- Lift, drag, circulation, pressure distribution-theory of thin aerofoils – Problems

UNIT V - INTRODUCTION TO WAVE HYDRODYNAMICS

Regular and random wave description, waves and their properties, Irregular Sea – Analysis methods, Regular waves - Linear wave theory, Boundary conditions, assumptions, Governing Equations,– Dispersion relation, water particle kinematics, orbital motion; Group velocity and its dynamical significance, waves behaviour in deep water and shallow water, wave pressure, energy and power; Wave deformation basics - Problems

Total : 60 Hours

TEXT BOOKS

1. S.K Som, Gautham Biswas, S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Mc Graw Hill, 2011
2. R.K Bansal, A textbook of Fluid Mechanics, Laxmi Publications, 2008
3. J.S Mani, Coastal Hydrodynamics, PHI Learning Private Limited, 2012

REFERENCES

1. Fluid Mechanics, Walther Kaufmann, Tata McGraw-Hill Publishing Co, Ltd., 1963.
2. Boundary Layer Theory, Schlichting, Springer Verlag, 2001
3. Applied Hydrodynamics, Vallentine, Newness - Butterworth, 1967.
4. Marine Hydrodynamics, Newman, J. N., Cambridge, MA: MIT Press, 1977

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering					
Course Code UCNA405	FUNDAMENTALS OF OFFSHORE STRUCTURES		L	T	P	C
			3	0	0	3
Year and Semester	II Year (IV Semester)		Contact hours per week (3Hrs)			
Prerequisite course	NIL					
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
			✓			
	Basic Science	Engineering Science	Open Elective	Mandatory		
Course Objective	Knowing various types of fixed and floating offshore structures, their components and installation methods					
Course Outcome	After completion of the course, the students will be able to: 1. Distinguish the different types of offshore structures and their components 2. Identify the type of loads taken place on structure and mooring lines 3. Choose suitable material for offshore structures 4. Select the types of mooring and risers 5. Choose type of installation methods taken place in offshore industry 6. Identify different types of offshore structures elements, material used for structures and installation methods.					

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	1	1	-	2	1	2	-	2	3	2	2
CO2	3	3	-	-	2	2	-	1	2	2	-	2	3	3	3

CO3	3	3	-	-	1	3	2	2	-	2	-	2	3	3	3
CO4	3	3	-	-	3	2	3	2	1	1	-	2	2	3	3
CO5	3	3	-	-	3	3	3	2	-	-	-	2	2	3	3
CO6	3	2	-	-	3	3	2	2	-	-	-	3	3	3	3
AVERAGE	2.7	2.7	0.0	0.0	2.2	2.3	2.5	1.8	1.3	1.8	0.0	2.2	2.7	2.8	2.8
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - FIXED STRUCTURES

Introduction to Offshore Structures: Deepwater challenges – Functions of Offshore Structures – Offshore Structure Configurations – Bottom – Supported Fixed Structures

UNIT II - FLOATING STRUCTURES

Introduction to Floating Structures: Tension Leg Platform, Spar, Semi-Submersible, FPSO, Articulated Structures - Complaint Structures – Floating Structures and Complex Platform

UNITS III - MATERIAL FOR OFFSHORE CONSTRUCTION

Introduction – Structural Steel – Topside Materials – Advanced Composite materials – Corrosion Control – Material Reliability and Monitoring – Fracture Control, Introduction to different loads acting on structures, Structural arrangements in Fixed and Floating Structures

UNITS IV – MOORING AND RISERS

Introduction to Mooring and Risers - Mooring configurations: single-leg mooring, spread mooring, Turret mooring; mooring components: wire ropes, synthetic fibre ropes, chains, drag and suction anchors, piles; winches and windlass, Umbilical, Riser – different types of risers ; Riser components, Industry standards and classification rules, General layout Considerations

UNITS V - OFFSHORE INSTALLATION

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

Total : 45 Hours

TEXT BOOKS

1. Subrata K Ckakrabarti., Handbook of Offshore Engineering Vol
2. Dawson, T.H., Offshore Structural Engineering Prentice Hall, 1983

REFERENCE BOOKS	
Graff, W.J., Introduction to Offshore Structures, Gulf Publ. Co. 1981	
Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	SHIP DESIGN CALCULATION DRAWING & DRAFTING - II (SDCADD - II)	L	T	P	C
UCNA4PA		0	0	2	1

Year and Semester	II Year (IV Semester)	Contact hours per week (2Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. To perform hydrostatic calculations & bonjeans 2. To study & perform the role of Cross curves of stability 3. To understand the concept of Shell Expansion
Course Outcome	After completion of the course, the students will be able to: 1. Evaluate various hydrostatic particulars in ship 2. Sketch the hydrostatic curves manually and in software for various conditions 3. Illustrate the Cross curves of stability for various heeling condition 4. Sketch Bonjean curves manually and in AutoCAD 5. Estimate the Wetted surface area and painting surface area. 6. Develop the shell expansion plan

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	3	2	1	-	1	2	2

CO2	2	2	1	-	-	-	-	-	3	2	1	-	1	2	3
CO3	2	2	1	-	-	-	-	-	2	2	1	-	1	2	2
CO4	2	2	1	-	-	-	-	-	3	2	1	-	1	2	2
CO5	2	2	1	-	-	-	-	-	3	2	1	-	1	2	3
CO6	2	2	1	-	-	-	-	-	2	2	1	-	2	3	3
AVERAGE	2	2	1	0	0	0	0	0	2.7	2	1	0	1.2	2.2	2.5

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

LIST OF ASSIGNMENTS

1. Hydrostatic calculation for various loading conditions
2. Plotting of Hydrostatic curves for various loading conditions.
3. Cross curves of Stability for various Heeling conditions
4. Bonjean curves calculation and plotting for various loading condition
5. Calculation of Wetted surface area and Paint surface area
6. Shell Expansion plan for the given particulars

Total : 30 Hours

TEXT BOOKS

1. Robert Taggard, ship design & construction, The society of naval
2. Eric c.tupper, Introduction to naval architecture, reed Elsevier India pvt lmt,2010

REFERENCE BOOKS:

1. Principle of naval architecture, vol I

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA4PB	SOFTWARE LABORATORY - I	L	T	P	C
		0	0	2	1
Year and Semester	II Year (IV Semester)	Contact hours per week (2Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	Knowing the various surface generation techniques using appropriate Software				
Course Outcome	After completion of the course, the students will be able to: 1. Create a primitive shapes (plane,block,cylinder..) 2. Create Lines plan and Develop Hull form hydrostatics curves 3. Perform fairing of hull lines using the appropriate tools 4. Generate surface of the given model using appropriate tools available in the Software 5. Perform Area calculations 6. Develop the hull 3D model				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	3	2	1	-	1	2	3
CO2	2	2	1	-	-	-	-	-	3	2	1	-	1	2	3

CO3	2	2	1	-	-	-	-	-	2	2	1	-	1	2	3
CO4	2	2	1	-	-	-	-	-	3	2	1	-	1	2	3
CO5	2	2	1	-	-	-	-	-	3	2	1	-	1	2	3
CO6	2	2	1	-	-	-	-	-	2	2	1	-	1	2	3
AVERAGE	2.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	2.7	2.0	1.0	0.0	1.0	2.0	3.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

- Primitive creation – plane, block, pyramid, cylinder, cone, sphere, toroid's.
- Curved surface creation – swept, extruded, rotated, skinned surfaces, 3 or 4 boundary interpolated patches, tube.
- Curve primitives – polylines, splines, lines, arc, ellipse, NACA sections.
- Surface operations – subtract, unite, solid intersection, intersect, imprint, join, combine, blend, scale, move, rotate, align, reflect, copy, concatenate, control point editing.
- 2D operations – join, trim, cross, offset, fillet.
- Visualization – principal curvature, curvature tufts, Gaussian, isophotes, transparency, lights.
- Interactive point and curve editing
- Reference Curves provide a base for hull form development
- Traditional 2D or advanced 3D fairing
- Automatic curve fairing and data reduction
- Special handling of waterline endings and frame feet
- Hull form hydrostatics
- Sectional area curve distortions and scaling
- Lines plans and loft books

Total : 30 Hours

REFERENCES

1. Software manual

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	AMET CENTRE FOR IELTS				
Course Code UCLECPE	Soft Skill- IV	L	T	P	C
		0	0	3	2
Year and Semester	II Year (IV Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	✓				
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. Knowing the corporate culture and the professional ethics 2. Preparing them to achieve their organizational goals				
Course Outcome	After completion of the course, the students will be able to: 1. Improvise on the usage of grammar and vocabulary in all circumstances 2. Prepare them as oneself expressing behavioral ethics 3. Collaborate with individual such as to improve pronunciation 4. Distinguish between standards and illustrate a change in listening and speaking skills 5. Formulate and apply various forms of written communications that are learnt 6. Construct themselves with active participation in the class and understand concepts. Will be ready to handle large groups without any fear.				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	3	2	3	3	-	1	2	1
CO2	-	-	-	-	-	-	-	3	2	3	3	-	1	2	1

CO3	-	-	-	-	-	-	-	2	3	3	3	-	1	2	1
CO4	-	-	-	-	-	-	-	3	2	3	3	-	1	2	1
CO5	-	-	-	-	-	-	-	3	2	3	3	-	1	2	1
CO6	-	-	-	-	-	-	-	3	2	3	3	-	1	2	1
AVERAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.2	3.0	3.0	0.0	1.0	2.0	1.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT1:GRAMMARANDFOUNDATON

Training the students on basic grammar and foundation and laying the standard platform. A complete standard syllabus of Cambridge is used. The main part of the 1st semester is to cover the major tenses (Present tense, Present Continuous, Past Tense, Past Continuous, Present Perfect, and Present Perfect continuous.

UNITII:PROFESSIONALETHICS :

How to address the gathering, people, authorities, open forum, how to conduct the meetings, huddle, calibration. Learning about organizational behaviors, achieving organizational goals, nurturing professional integrity.

UNITIII:INTERACTIVEENGLISH

Second level: The main objective is English for International communication. It course contains conversations, snapshots, readings, activities, a greater variety and amount of listening materials and more visuals to introduce vocabulary, more opportunities to build fluency, and up-to-date art and design. The course covers the fours skills of listening, speaking, reading and writing, as well as improving pronunciation and building vocabulary.

UNITIV:LISTENINGANDSPEAKING

Basics of International listening, reading, writing and speaking skills.

UNIT V: WRITTEN ENGLISH

How to write memos, emails, short notes, drafting of letters , requesting leave, permission, reports, requisitions, approvals and indents.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Essential Grammar in use- Raymond Murphy ,Cambridge , New Third Edition

2. Communication Skills

REFERENCE BOOKS:

1. New Interchange (English for International Communication) Jack C. Richards

Designed by	" Department of Naval Architecture & Offshore Engineering"

SEMESTER: V

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA501	RESISTANCE AND PROPULSION OF SHIPS	4	0	0	4

Year and Semester	III Year (V Semester)	Contact hours per week	
Prerequisite course	NIL	(4Hrs)	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To understand the various components of ship resistance and propulsion and their evaluation using different theoretical methods*	
Course Outcome	Students will be able to	
	1	Estimate the various types of resistance acting on different ships.
	2	Demonstrate the model testing conducted in Towing Tank using Froude's method.

	3	Compare the results of resistance by model testing and theoretical series method
	4	Illustrate the fundamental aspects of ship propulsion.
	5	Practice the preliminary design procedures of propeller with respect to hydrodynamic and strength part of propeller
	6	Design ship propulsion device

POS/COS	PPO 1	PPO 2	PPO 3	PPO 4	PPO 5	PPO 6	PPO7	PP O8	PPO 9	PPO1 0	PPO1 1	PPO1 2	PPSO 1	PPSO 2	PPSO 3
CO1	1	2	0	3	1	0	1	1	0	2	0	0	0	0	0
CO2	2	2	1	2	1	0	0	0	1	2	0	1	2	0	0
CO3	2	2	0	1	1	0	0	1	0	1	0	1	0	0	0
CO4	2	2	1	3	2	0	0	0	0	2	0	1	2	0	1
CO5	2	0	1	1	2	0	0	1	0	1	0	0	2	0	1
CO6	2	2	2	3	1	0	0	1	0	1	0	0	1	0	1
AVERAGE	1.8	2.0	1.2	2.2	1.3	0	1.00	1.0	1.0	1.5	0	1.0	1.75	0	1.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - INTRODUCTION TO RESISTANCE

Concept of resistance, flow of non-viscous and viscous fluids past submerged bodies and surface of ships, Introduction to important components of resistance such as frictional resistance, wave making resistance, eddy making resistance and air & wind resistance, Dimensional analysis, conditions of similarity, corresponding speeds of ship and model, Introduction to towing tank experiments and determination of ship resistance

UNIT II - VISCOUS RESISTANCE AND AIR & WIND RESISTANCE

Froude's experiments with planks and plates, Reynold's experiments with pipes, Turbulence stimulation, friction lines, form resistance, boundary layer separation, effect of hull roughness, appendage drag, resistance in shallow water full scale tests and ship model correlation

UNIT III - WAVE RESISTANCE, ESTIMATION OF TOTAL RESISTANCE AND EFFECTIVE HORSEPOWER

Kelvin wave pattern, waves generated by ship, wave interference, Froude's method of resistance prediction. Resistance data presentation, estimation of total resistance and effective power (theoretical method), trail and service allowances (using empirical methods).

UNIT IV - PROPELLER DESIGN AND HULL PROPELLER INTERACTION

Screw propeller terminology and geometry, Dimensional analysis and conditions of similarity, Propeller in open water, Propeller coefficients, hull- propeller interaction, wake and thrust deduction, hull efficiency, relative rotative efficiency, propulsive coefficient. Cavitation, fully cavitating propellers, Introduction to Propeller design, Elementary treatment including basic principles of momentum theory, blade element theory and Circulation Theory

UNIT V - SHIP PROPULSION DEVICES, PREDICTION OF SHIP'S POWER AND STRENGTH OF PROPELLERS

Ship Propulsion devices and their historical development, water jet propulsion, controllable pitch propellers, vertical axis propellers, shrouded propellers, tandem and contra-rotating propellers and paddle-wheels, super conducting electric propulsion, Model propulsion experiments in towing tanks and Cavitation tunnels, Ship trails and service performance analysis, estimation of power based on model experiments and propeller design charts, use of $B\rho$- δ charts, Kt- Kq- J diagrams. Propeller blade strength, methods of calculation, classification society rules, Propeller materials.

Total : 60 hours

TEXT BOOKS

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

REFERENCES

1. Ship Resistance and Propulsion- Practical estimation of Ship Propulsive Power
2. Marine Propellers and Propulsion by J.C.Carlton.

Designed by	"Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA502	STRENGTH OF SHIPS	4	0	0	4

Year and Semester	III Year (V Semester)	Contact hours per week (4Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To understand and evaluate the various loads acting on ship structures and to study ships strength to withstand the applied loads.*	
Course Outcome	Students will be able to	
	1	Estimate of various loads and framing arrangement of ship
	2	Calculate the section modulus and scantling calculations

	3	Explain Basics of ship vibration and methods to determine the dynamic response
	4	Interpret structural analysis and stiffening of plates
	5	Measure the response of ship for irregular load
	6	Analyze the ship structure under various loading conditions

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	2	2	1	1	3	1	1	2	1	1	--	2	1	3
CO2	1	2	2	1	1	3	1	1	1	1	1	--	2	2	3
CO3	1	2		1	1	--	2	2	1	1	1	2	--	1	1
CO4	3	3	2	2	2	1	2	1	--	3	1	--	1	1	2
CO5	1	1	--	1	1	--	1	1	1	2	1	2	--	1	1
CO6	1	1	--	1	1	--	1	1	1	2	1	2	2	1	1
Average	1.3	1.8	2.0	1.2	1.2	2.3	1.3	1.2	1.2	1.7	1.0	2.0	1.8	1.2	1.8
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM)					3. SUBSTANTIAL (HIGH)				

UNIT 1 – INTRODUCTION TO SHIP STRENGTH

Structural design concept and philosophy, various forces acting on ship structures in still water: Loads, Weight and Weight distribution, Buoyancy and Buoyancy distribution. Load Curve, shear force curve, bending moment curve, and deflection curve, wave bending curve, Basics on thermal loads and their effects

UNIT 2 - STRENGTH OF HULL

Longitudinal strength: Application of beam theory, Hull girder section modulus calculation, Shear stress distribution in cross section, Introduction to shear center and torsion of hull, Transverse Strength

UNIT 3 - PLATE THEORY AND APPLICATION

Thin plate theory for different loading condition and boundary conditions, Solution for different boundary conditions, Application of plain stress theory to ship structural problems, Buckling of plates, Influence of stiffeners (longitudinal and \ or transverse) on the bending and buckling stress of ship's plating

UNIT 4 - IRREGULAR WAVE LOAD AND RESPONSE

Loads in seaway: Moments due to regular waves and oblique waves. Representation of irregular seaway, Short term and long term distribution of loads, Spectral approach to response of ship structures, Effects of slamming and shipping of green seas, Sources of vibration in ship, basic terminology of dynamics, measures to control vibration, natural frequency determination-methods

UNIT 5 – INTRODUCTION TO STATUTORY REGULATIONS AND CLASSIFICATION RULES

IMO convention and relevance to ship design/construction- Basic concepts of SOLAS, MARPOL, STCW, IACS organization & its role in ship design and construction, role of MMD, flag condition of different nation, tonnage regulation

Total: 60 hours

TEXT BOOKS

1. Muckle. W Strength of Ships

2. Lewis, E U. Principles of Naval Architecture (2nd Rev) Vol III 1989 SNAME, New York, Owen Hughes, Ship Structural design

3. Mechanical Vibrations by V.P Singh

REFERENCES

1. Mechanics of Materials, James M. Gere, Stephon P. Temoshenko
2. Ship Construction by D.J.Eyres Merchant Ship Construction by D.A.Taylor
3. Alaa Mansour, Don Liu, Principles of Naval Architecture Series: Strength of ships and ocean structures, SNAME, New Jersey, 2008.
4. Owen. F. Hughes and Jeom Kee Paik – Ship Structural Analysis and Design, SNAME, New York., 2008.
5. Mohammed Shama – Torsion and Shear Stresses in Ships, Springer - Verlag, 2010.

Designed by	"Department of Naval Architecture & Offshore Engineering "

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA503	DESIGN OF OFFSHORE STRUCTURES	4	0	0	4

Year and Semester	III Year (V Semester)	Contact hours per week (4 Hrs)
Prerequisite course	NIL	

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To understand the principle involved in the design procedure of offshore structures for static, dynamic and accidental loads following the standards and regulations*	
Course Outcome	Students will be able to	
	1	Plan and successfully design an offshore platform
	2	Estimate punching shear and joint capacity calculations including fatigue analysis

	3	Design structure against accidental loading
	4	Analyze the stability of submarine pipelines
	5	Design of floating structures and semi floating structures
	6	Design an offshore structure

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	1	2	2	1	-	-	-	-	1	-	-	2	2	2
CO2	2	2	3	3	1	-	-	-	-	1	-	-	2	2	2
CO3	2	2	3	3	2	-	-	-	-	1	-	-	2	2	2
CO4	2	2	3	2	2	-	-	-	-	1	-	-	2	2	2
C05	2	3	2	3	2	-	-	-	-	2	-	-	2	2	2
C06	2	3	2	3	2	-	-		-	2	-	-	2	2	2
Average	1.8	2.2	2.5	2.7	1.7					1.3			2.0	2.0	2.0
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I - DESIGN PRINCIPLES AND METHODS

Introduction - Types of offshore structures and structural components, Planning of Offshore Structures; Design criteria and procedures, Design requirements. Loads on offshore structures, Static and dynamic loads - Wind Loads, Wave loads – Morison equation, Current Loads. Design of Fixed platform - based on Maximum base Shear and Overturning Moments. Steel Tubular Member, Design Principles of WSD and LRFD

UNIT II – STATIC AND DYNAMIC LOADS

Design of jacket structure against static loading - Allowable stresses and Partial Safety Factors; Design for combined stresses- as per API RP 2A guidelines. Design for Cyclic Loads- Design Wave approach. Simple tubular joints, design using allowable loads; Fatigue -stress concentration factors; S-N curves and fatigue damage calculations

UNIT III - ACCIDENTAL LOADS

Design against accidental loading (Fir, blast and collision), Plastic design method, Lifting and Transportation analysis, Redundant framing arrangement; Launch and Lift jackets; Simple Deck configurations for Lift and float-over installations; In-service and Pre-service Loads and analysis. Basics involved in the design of superstructure

UNIT IV- SUBMARINE PIPELINES

Design of submarine pipe line and Risers, Route selection and Diameter / wall thickness calculations; Pipeline stability, free span calculations; Concrete coated pipelines and pipe-in-pipe insulated pipelines.

UNIT V- DESIGN OF FLOATING STRUCTURES

Design criteria, Column stabilized structures; design of pontoons; Tension leg platforms; Tethers selection and design; Spar hulls; classic, truss and cell spar; Spar hull compartments and design of shell structures; offshore wind turbine support structures. Overview on decommissioning of offshore platforms

Total: 60 Hours

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 or ASD)

2. API RP 2A (LRFD)

3. Offshore structures design, construction and Maintenance by Mohamed A. EI-Reedy

Designed by	"Department of Naval Architecture & Offshore Engineering "

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA504	HULL SURVEY AND HULL HEALTH MONITORING	3	0	0	3
Year and Semester	III Year (V Semester)	Contact hours per week (3 Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To have fair awareness of Survey procedure and its relevance and to adopt protective measures and monitor hull condition with respect to corrosion*	
Course Outcome	At the end of this course students should be able to	
	1	Explain about Hull survey and its methods.
	2	Choose protective coating and other corrosion protection systems.

	3	Examine the corrosion zones in a vessel.
	4	Imbibe capability to monitor Hull condition
	5	Define the hull defects and prescribing corrective actions
	6	Choose proper survey method and assess hull defects

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	-	-	-	1	2	-	-	1	2	-	1	2	2	1
CO2	1	1	-	1	1	1	-	-	-	2	-	1	2	2	1
CO3	1	1	-	1	1	1	-	-	-	2	-	1	2	2	1
CO4	-	-	1	-	1	1	1	-	1	2	1	1	2	2	1
C05	-	-	-	1	1	1	1	-	-	2	1	1	2	2	1
C06	1	1	-	1	1	1	-	-	-	2	-	1	2	2	1
Average	0.7	0.5	0.2	0.7	1	1.1	0.3		0.3	2	0.3	1	2	2	1
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT 1 – INTRODUCTION TO HULL MATERIAL AND ITS RELEVANCE IN SURVEY

Types of Ship; Operation Cycle of Ships, Overview of Materials for Shipbuilding; Types of Ship building Steel- Grade A, B, DH 36, EH 36. Purpose /utility of high grade steel, Definition of ICE class- its relevance with steel quality. Precautions in dealing with Higher grade steel.

Scantling of ship and its relevance in survey of Ship, relevance of shell expansion drawing in hull survey, Tonnage Survey and Calculations

UNIT II - FUNDAMENTALS OF HULL SURVEY

Survey (Hull and Machinery), Need for hull survey; Periodicity of Hull survey, Types of Hull survey, Methods of hull survey - Visual, Hammer, Ultrasonic thickness gauging, Ultrasonic survey. Method of recording Survey findings, Survey Report, Analysing survey report, K- Factor Calculation, Standards of Hull Health; Classification of Hull status – Sound, Defective, Suspect, Critical

UNIT III – HULL STRUCTURAL SURVEY DURING CONSTRUCTION

Hull Structural standards, IACS standards, Ship Building Standards, Ship Repair Standards (Recap)

Classification Survey during Construction- Steel traceability, Online survey and reporting, inspection of welders and welder certification. Stage wise survey of structure- Dry survey procedure (Include Dimensional and Diagonal checks) and corrective action. QAP on Construction - by Yard QC, Classification Society, Owner's Rep, PSPC criterion for structural parts for painting, Class Survey during Erection – Alignment and tolerances, Dimensional Survey of Hull, Mandatory NDT tests, Load Line survey, Draft mark survey, Prelaunch inspection by class, Anchor arrangement survey by owners, Outfitting Survey – PII, III, FII, Compartment survey, Compartment and Tank testing, Installation Survey of machinery, shafting and others

UNIT IV – SALIENT FEATURES OF SURVEY DURING SHIP REPAIR

Hull Survey during ship repair, Hull defect Survey – Survey of U/w hull external, u/w hull internal structures, Survey of inaccessible areas, Survey of Tiled Deck, Survey of Wet compartment, Inspection of load carrying welded hull fitting. Critical areas of inspection prone to corrosion and deterioration, Recoding of Survey remarks- Survey Report

Defining the hull defect and prescribing corrective action. Relevance of Hull condition status and action to be taken on Hull survey report, Ship Defect List; Hull Maintenance Schedule, Introduction to Principles of Hull survey regulations of Naval ships, Typical survey remarks of Naval Hull survey (DO, DAN, DOSSRR, E&R). Estimating the comprehensive work to be undertaken as per survey report- Ancillary work, Degutting and Regutting work

UNIT V- HULL PROTECTION AND MONITORING

Hull Corrosion Protection system, Fundamentals of protective coating, Defects and effects of coatings, Differential Corrosion, Preferential corrosion, Galvanic Cell, Sacrificial Anodes - Types, ICCP system, Underwater Inspection and Hull survey, Survey of Sacrificial Anodes, Survey of ICCP system components. Hull Health Monitoring- Potential Measurements,

Standard Hull potential, Hanging Anodes, Hull Inspections-Underwater, Underwater internal, ship Structural, Wet compartments, Corrosion Prone Areas and its inspection / monitoring

Total : 45 Hours

TEXT BOOKS

1. Eyres,D.J , Ship construction,1994

2. Taylor,D.A, Merchant ship construction ,2002

3. Kemp, Ship construction ,2002

4. Pursey,H.J , Merchant ship construction ,2002

REFERENCE	
1. Guide for hull inspection and maintenance program ABS 2. Ship Surveys and Inspection, Great Britain, National Audit Office.	
Designed by	" Department of Naval Architecture & Offshore Engineering "

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA505	FOUNDATION OF OFFSHORE STRUCTURES	3	0	0	3

Year and Semester	III Year (V Semester)	Contact hours per week (3 Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To learn site investigation, categorize and characterize soils for foundation design, estimation of the capacity of foundations and the settlement of the soil under the foundation load. Also the subject teaches the principles that govern flow of water in soils, settlement and heave of soils and shear strength of soils.* .
Course Outcome	At the end of this course students should be able to

	1	Choose appropriate drilling, sampling and field property measurement tools for different soil profiles.
	2	Specify necessary laboratory tests to understand the site-specific behavior of foundations
	3	Evaluate laboratory and field data to select appropriate shear strength values to use in foundation analysis
	4	Design and Analysis of Shallow Foundations:
	5	Design and Analysis of Deep Foundations
	6	Choose a suitable foundation and its design for a fixed offshore structure

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	1	2	2	1	-	-	-	-	1	-	-	2	2	2
CO2	2	2	3	3	1	-	-	-	-	1	-	-	2	2	2
CO3	2	2	3	3	2	-	-	-	-	1	-	-	2	2	2
CO4	2	2	3	2	2	-	-	-	-	1	-	-	2	2	2
C05	2	3	2	3	2	-	-	-	-	2	-	-	2	2	2
C06	2	3	2	3	2	-	-		-	2	-	-	2	2	2
	1.8	2.1	2.5	2.6	1.6					1.3			2.0	2.0	2.0
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I - BASICS OF SOIL MECHANICS

Basic Soil Mechanics: soil classification, three-phase system, fundamental definitions, relationship and interrelationships, permeability & seepage, effective stress principle, consolidation, compaction, shear strength. Basic soil properties, correlation between engineering parameters, bore log. Site investigation objective, Sea bottom surveys, soil investigation and techniques

UNIT II - FOUNDATION OF FIXED OFFSHORE STRUCTURES

Foundation types-foundation design requirements. Deep foundations – pile types, Pile foundation: Jacket main piles, skirt piles, driven piles, drilled and grouted piles, steel and concrete piles. Pile design: axial capacity, point bearing and skin friction, factor of safety, Axial load transfer (t-z) curves, Tip load –Displacement(Q-z) curve .Lateral load on piles, Load-deflection (p-y) curves, and q-z curves, pile group effect, scour around piles, seabed subsidence and design of piles against seabed movement, negative skin friction.

UNIT III - INSTALLATION OF PILE FOUNDATION

Pile Installation: Pile wall thickness, Allowable pile stress, Design pile stresses, Stresses during pile driving stresses, static and dynamic stresses, Fatigue damage calculation n while pile driving, API RP 2A guidelines.

UNIT IV - PILE LOAD TESTING

Pile Testing: Working load test, ultimate load test, pile monitoring during driving, pile integrity testing, high strain dynamic testing, rebound method, pile refusers

UNIT V - SPECIAL OFFSHORE FOUNDATIONS

Introduction to Special Foundations: Mud-mats: bearing capacity, sliding stability, overturning stability, short term and long term settlements, Bucket foundation; Suction anchors; Gravity foundation.

Total: 45 Hours

TEXT BOOKS

1. Handbook of Offshore Engineering by S.K. Chakrabarti, Elseviers, 2005.

2. Tomlinson, M. J., Pile Design and Construction, E and F Spon, 1994

3. Pile Design and Construction by M. J. Tomlinson, E & FN Spon, 1994.

4. Foundation analysis and design by J. E. Bowles, McGraw-Hill, 1988

REFERENCES

1. Construction of Marine and Offshore Structures by Ben C. Gerwick, CRC Press 1999
2. Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms –API RP 2A

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code UCNA506	Course Name: STATUTORY REGULATIONS AND CLASSIFICATION RULES	**L** 3	**T** 0	**P** 0	**C** 3
Year and Semester	III Year (V Semester)	Contact hours per week (3 Hrs)			
Prerequisite course	NIL				

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To understand the role of IMO and classification society and the relevance of Codes & Conventions in ship construction*	
Course Outcome	At the end of the course the student should be able to:	
	1	Describe the importance of classification society in Ship building
	2	Practice IMO conventions

	3	Practice IMO codes
	4	Practice safety survey and draft survey
	5	Practice statutory survey and Periodic survey
	6	Apply technical guidelines, rules and regulations which are offered by various classification societies in marine industry.

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	1	-	-	1	2	3	3	1	2	1	-	-	2	-
CO2	3	2	-	-	2	-	-	-	-	-	2	-	-	3	-
CO3	3	2	-	-	2	-	-	-	-	-	2	-	-	3	-
CO4	2	2	-	-	1	-	-	-	1	2	2	-	-	3	-
C05	2	2	-	-	1	-	-	-	1	2	2	-	-	3	-
C06	3	2	2	2	3	-	1	-	1	3	3	2	2	3	2
Average	2.3	1.8	0.3	0.3	1.7	0.3	0.7	0.5	0.7	1.5	2	0.3	0.3	2.8	0.3
CORRELATION LEVELS			1. SLIGHT (LOW)					2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I - INTRODUCTION TO IMO & ILO

Introduction to Development of Codes & Conventions, Classification society rules and roles in ship building-History of Classification society-IACS organization activities –other roles of Classification society in shipping, DG shipping, MMD rules, flag, tonnage regulations

UNIT 2 - IMO CONVENTIONS

IMO conventions & its relevance to ship construction, Basic concepts of SOLAS, MARPOL, STCW

UNIT 3 - IMO CODES

Basic concepts of FSS, LSA, ISM, - FSS, LSA plan –Emergency preparedness and plan

UNIT 4 - SAFETY SURVEY

Introduction to safety survey, Draft survey-Cargo survey-Refit and operational cycle

UNIT 5 - STATUTORY SURVEY

Introduction to statutory survey, Periodic survey, Re classification survey, Damage survey

Total : 45 Hours

REFERENCES

1. IMO Publications and Documents
2. IACS Publications and Documents
3. MARPOL and SOLAS Code

Designed by	"Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA507	MARINE TRANSPORTATION AND ENGINEERING ECONOMICS	3	0	0	3

Year and Semester	III Year (V Semester)	Contact hours per week (3Hrs)	
Prerequisite course	NIL		

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objectives	1. Awareness of working of shipping organization 2. Learn about the economics in engineering 3. Student should able to solve transportation problems using different methods
Course Outcome	Students will be able to

	1	Identify the various cargo transported with various ships
	2	Identify the cost estimation for transporting of cargo
	3	Understand the concept of Marine insurance to follow
	4	Analyse the demand report for various requirements
	5	Evaluate the route for transportation and their cost evaluation
	6	Identify the policy methods used in shipping industry

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	-	-	1	1	2	1	-	-	-	2	-	1	1	2	2
CO2	-	-	2	2	1	1	1	-	-	2	-	1	2	1	2
CO3	-	-	2	2	1	1	1	1	-	2	-	1	2	1	2
CO4	-	-	2	2	1	1	1	1	-	2	-	1	2	1	2
C05	-	-	2	2	2	1	1	1	-	2	1	1	2	1	2
C06	-	-	2	2	2	1	1	1	-	2	1	1	2	1	2
Average			1.8	1.8	1.5	1	1	1		2	1	1	1.8	1.1	2
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM)						3. SUBSTANTIAL (HIGH)			

UNIT - I - Ships and cargoes

Development in shipping and cargo handling, Principle shipping organization. Liner and tramp shipping services, conference system, Chartering Charter parties, Theory of freight rates. Bill of lading. Carriage of goods by sea act. Introduction to transport economics-Traffic and transportation system- difference between traffic and transportation system measuring traffic transport performance-Regulation of road, rail transport and inland waterway transport

UNIT- II - Economics of transport management

Direct cost of transportation and cost recovery-cost calculation in a transport- Time cost and distance costs- Hour efficient and kilometer efficient variable costs-common costs-costs for peak and off-peak periods-Waiting time in transport firms.Risk management, processes and practice. Underwriting and loss adjustment principles applied to marine insurance, Particular average. General average. P&I clubs. Hull policy

UNIT- III – Transportation Methods

Routing-shortest path method- Round trip method-assignments of origin and destination pricing in a transport firm- optimum size and composition of the vehicle fleet- optimal replacement logistical costs-concept of business logistics- transportation costs- Handling costs- Inventory costs-External costs of transport Ownership of vessel, Shipping company and its administration. Ship management, Open register. Manning of ships. Engagement and discharge of crew, Seamans welfare

UNIT- IV - Transport supply and demand

Demand for transport-Aggregate models- micro economic approach to transport –choice behavior-empirical application- demand analysis Salient features, Registration of ship, Ships paper. Duties regarding pollution, Shipping causalities, Penalties under merchant shipping Act

UNIT- V - Transport policy

Charging for external costs- pricing policy- Infrastructure policy- role of transport economist in government.Economics of new and second hand tonnage, Laying up of ships. Ship acquisition and subsidies repairs and maintenance Difference between repairs and maintenance, Voyage and dry-dock repairs, Types of maintenance (breakdown, planned and condition monitoring)

.

Total : 45 Hours

Text books:

1. Gust Baluwens, Peter De Baere, Eddy Van de Voorde, " Transport Economics, De boeck publication
2. Emile Quinet and Roger Vickermand, Principles of Transport Economics, EE publication
3. Pradeepta Kumar Samanta, Port Infrastructure and economic development, Kalpaz publ. (Delhi)

References:

1. Classification society rules-Indian registrar of shipping
2. Institute of chartered ship brokers-tutorship London
3. Shipping practice-EF stevens and CSI butterfield

Designed by	" Department of Naval Architecture & Offshore Engineering "

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA508	PHYSICAL OCEANOGRAPHY AND OCEAN RESOURCES	3	0	0	3

Year and Semester	III Year (V Semester)	Contact hours per week (3 Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objectives	*To understand the physical properties and phenomenon of the ocean and to have a general idea about the ocean resources and their explorations*
	At the end of the course the students should be able to

Course Outcome	1	Illustrate the basic ocean characteristics, their physical properties and the methods of measurements
	2	Identify the various ocean instruments used to measure the Environment changes
	3	Analyse the influence of the ocean circulation in global climate change
	4	Utilise the data collection from ocean and exploite it
	5	Perform the stability calculation for semi-submersible platform
	6	Explore the methods to explore the ocean resources

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 1
CO1	-	-	-	-	2	1	1	1	-	2	-	1	-	1	2
CO2	-	-	1	1	2	2	2	1	1	2	1	1	1	2	2
CO3	-	-	-	-	1	1	1	2	2	2	2	1	-	2	2
CO4	-	-		-	1	1	1	2	1	2	2	1	-	2	2
C05	-	-	-	-	2	1	1	2	2	2	2	1	-	2	2
C06	-	-	1	1	2	1	1	2	1	2	2	1	-	2	2
Average			1	1	1.6	1.1	1.1	1.6	1.4	2	1.8	1	1	1.8	2
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

Unit I – Introduction to Physical Oceanography (10 hours)

General introduction – history of oceanography – expeditions - geomorphology and structures of the ocean floor, Continental slope and shelf - Physical properties of sea water- distribution of temperature, salinity, density and oxygen in space and time – PSU and TEOS-10 - acoustical and optical characteristics of seawater – color of the sea.

Unit II – Oceanographic platforms (8 hours)

Oceanographic platforms: Research vessels and their facilities - Ocean Instruments: measurements of depth, light, temperature, salinity, currents, waves and tides.

Unit III – Ocean Circulation (12 hours)

Water masses: formation and classification - T-S diagram – water masses of the world oceans – Indian Ocean water masses - identification of water masses. Circulation: general circulation of

ocean and atmosphere — Ekman spiral and transport – Currents in the oceans - wind-driven circulation, thermohaline circulation - upwelling and sinking - El-Nino and La-Nina and ENSO.

Unit IV – Ocean Resources (7 hours)

Ocean Resources: definition and classification, potential uses of sea. Geophysical and oceanographic operations: direct and indirect methods of data collection on and below sea surface, Involvement of ocean scientists in exploration and exploitation, phases of marine resources.

Unit V – Exploration of Ocean Resources (8 hours)

Mineral and hydrocarbon resources, exploration, development, and production of hydrocarbons, ocean mining, semi-submersible and their functions, stability, motion and weight.

Total : 45 Hours

TEXT BOOKS

1. Descriptive Physical Oceanography: An introduction: G.L.Pickard and W. J. Emery, Pergamon, 5th edn., 1992.
2. Descriptive Physical Oceanography : M.P.M.Reddy, Balkema, 1st edn., 2001.
3. The Oceans: H.U. Sverdrup, Prentice Hall, 1st edn., 1942
4. Introduction to Physical Oceanography : Robert H. Stewart, e-book, 2005.
5. Principles of Physical Oceanography: G.Neumann & WJ Pierson, Jr., Prentice Hall,1st edn.,1966.

REFERENCES

1. Introduction to Energy Resources, Technology and Society :E S Cassdy, Elsevier, 1st edn., 2000.
2. Underwater Minerals : D S Cronon, Academic Press, 1st edn., 1980.
3. Ocean Year Book (Vol 1 – 4) : Borges & Ginsburg, The University of Chicago Press, 1983.
4. Mineral Wealth of the Ocean : Ghosh & Mukhopadyay, Oxford & IBH Pub. Co., 2nd, 1999

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA509	QUALITY HEALTH SAFETY AND ENVIRONMENTAL MANAGEMENT	3	0	0	3

Year and Semester	III Year (V Semester)	Contact hours per week (3Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objectives	*To understand the importance of the quality control, assurance and management system in ship building and to learn the necessity of ISO*	
Course Outcome	At the end of the course the student should be able to:	
	1	Describe different quality concepts
	2	Apply QA & QC in Ship Building

	3	Infer different Environmental management systems and Occupational Health and Safety Series System
	4	Explain the importance of ISM codes
	5	Practice ISO 9000 quality management system, ISO 14000 & OHSAS 18000.
	6	Apply quality measures in ship industry

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	-	-	-	-	2	1	1	1	-	2	-	1	-	1	2
CO2	-	-	1	1	2	2	2	1	1	2	1	1	1	2	2
CO3	-	-	-	-	1	1	1	2	2	2	2	1	-	2	2
CO4	-	-		-	1	1	1	2	1	2	2	1	-	2	2
C05	-	-	-	-	2	1	1	2	2	2	2	1	-	2	2
C06	-	-	1	1	2	1	1	2	1	2	2	1	-	2	2
Average			1	1	1.6	1.1	1.1	1.6	1.4	2	1.8	1	1	1.8	2
CORRELATION LEVELS			1. SLIGHT (LOW)					2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I - INTRODUCTION TO QUALITY CONCEPTS

Definitions of Quality, Quality control, Quality Assurance, Quality Management, Quality Management system, Total Quality Management (TQM). Four principles of TQM, Quality costs, Quality statements- Vision, Mission, Quality policy, Quality Objectives and Targets.

UNIT II - APPLICATION OF QA & QC IN SHIP BUILDING INDUSTRY

Identification of customer requirements, QA/QC Documentation requirements, Quality Planning, skilled Labour, Competency/Training and Awareness; Design and Development; control on vendors and purchased products, operational control including control on welding processes; monitoring and measurement of processes, inspection and testing on

- Raw material, in-process and final product;
- Pre-delivery inspection including Dry surveys I & II, Different methods of NDT Testing; Dock trials and sea Trials

UNIT III - ISO 9000 QUALITY MANAGEMENT SYSTEM

Need for ISO 9000 Quality Management system and Description of its elements, Major steps in achieving ISO 9000 certification – Awareness / Training, Documentation, Implementation Internal Audit, Audit methodology and auditor qualities External certification audit, Certification and annual verification audits, Quality awards – international quality awards and National quality awards

UNIT IV - INTRODUCTION TO ISO 14000 & OHSAS 18000

Introduction to the basic concepts of

a) Environmental management system (ISO 14001:2004 EMS)
b) Occupational Health and safety series system (OHSAS 18001:2007).

Environmental aspects and impact assessment in and determining controls in EMS, Hazard identification and risk assessment and determining controls in OHSAS, Operational control and Emergency Preparedness and Response (common to both EMS and OHSAS), Performance measurement including audit and management review and external certification. (Common to both EMS and OHSAS)

UNIT V - INTRODUCTION TO ISM CODE

ISM code (international safety management for safe operation of ships and for pollution prevention), Introduction to ISM code -Background and purpose, Documentation, planning for shipboard operations and implementation of operations including emergency preparedness and Response, Audit and certification (Interim and final). Certification of Both DOC (Document of compliance for company) and SMC (Safety Management certificate for ship); Periodical verification of the maintenance of ISM code

Total : 45 Hours

TEXT BOOKS

1. Total Quality Management by Dale. H.Besterfield and Others – PEARSON Education Inc (Indian Reprint – 2010)
2. Total Quality Management by Dr. D.D.Sharma. Sultan chand and sons New Delhi (Reprint 2005).
3. Implementing ISO 9000 QMS by pradeepkumar. Mathur – Vikas publishing House, New Delhi
4. A Text Book of Total Quality Management (for B.E,/ B.Tech VIII semester Anna University) By Prof. R.Ramakrishnan by Dhanam publications – Chennai

REFERENCES

1. International standard ISO 9001 Quality Management system –Requirements ISO 9001:2008(E) –Bureau of Indian standards Publications-Chennai
2. IS/ISO 14001: 2004 – Environmental management system – Requirements with Guidance for use – Bureau of Indian standards – Chennai

3. Occupational health and safety managements- Requirements (OHSAS 18001:2007) – Bureau of Indian standards publications – Chennai
4. International standard ISO 19011: 2011 – Guide lines for Auditing Management systems – Bureau of Indian standards Publications, Chennai
5. ISM code - Amended up to 2010 (IMO Publication, London).
6. ISPS code 2003 Edition – sterling book house – Mumbai

Designed by	" Department of Naval Architecture & Offshore Engineering "
PROGRAMME	BE- Naval Architecture & Offshore Engineering

Course Code	Course Name:	L	T	P	C
UBMEC01	MARINE ENGINEERING-I	3	0	0	3

Year and Semester	III Year (V Semester)	Contact hours per week (3 Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To learn the various components and the operation principle of different ship machineries, boilers and turbines*	
Course Outcome	At the end of the course the student should be able to:	
	1	Describe the Ship Machineries, Engine selection and their working principles
	2	Express good knowledge on the marine boilers and turbines

	3	Explain marine boiler systems and operation
	4	Describe Marine Steam turbines and operation
	5	Estimate the heating and ventilation requirements in ships
	6	Identify the machineries and auxiliary systems which are used in ships

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	-	-	-	-	1	-	-	-	2	-	1	1	1	-
CO2	1	-	1	-	1	1	-	-	-	2	-	1	1	1	-
CO3	1	-	1	-	1	1	-	-	-	2	-	1	1	1	-
CO4	1	-	-	-	-	1	-	-	-	2	-	1	1	1	-
C05	1	2	-	-	-	1	-	1	-	2	-	1	-	1	-
C06	1	-	1	-	1	1	-	-	-	2	-	1	1	1	-
Average	1.0	2.0	1.0	0	1.0	1.0	0	1.0	0	2.0	0	1.0	1.0	1.0	0
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I – SHIP MACHINERY

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 lube oil 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 ROOM

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 – MARINE BOILERS

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 - TURBINES

Marine Steam turbines - Types of turbines, compounding - reheat turbines, turbine construction, rotors, blades, casing, Gland sealing, diaphrams, nozzles, bearings, etc. Lubrication systems, expansion arrangements, control, gearing operating procedure.

UNIT V - REFRIGERATION

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, 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 : 45 Hours

REFERENCE BOOKS

1. Harrington; Marine Engineering, SNAME Publications
2. Pounder, C.C; Marine Diesel Engines, Newnen-Butterworths, London
3. Reed's Marine Engineering for Naval Architect
4. Taylor, D.A.; Introduction to Marine Engineering

Designed by	" Department of Marine Engineering "

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code UCNA5PA	Course Name: SHIP DESIGN CALCULATION DRAWING & DRAFTING - III (SDCADD - III)	**L** 0	**T** 0	**P** 4	**C** 2
Year and Semester	III Year (V Semester)	Contact hours per week (4Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	1. To study the various structural components in the Hull 2. To understand the structural design & calculation of ship hull 3. To study and perform the estimation of weight of the ship
	At the end of the course the student should be able to:

Course Out come	1	Develop the General Arrangement of ship
	2	Evaluate the Longitudinal strength for various loading conditions
	3	Prepare the Scantlings calculation for various structural components
	4	Estimate the Section modulus based on classification rule
	5	Evaluate the strength of Mid-ship section
	6	Estimate the Light weight and Dead weight of the ship

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
CO1	1	2	3	1	1	--	1	1	1	1	--	--	3	1	1
CO2	3	2	3	1	--	3	1	2	--	3	--	--	3	1	2
CO3	--	1	3	2	2	1	3	2	--	--	--	--	3	3	1
CO4	1	2	3	1	1	--	1	1	1	1	--	--	3	1	1
C05	3	2	3	1	--	3	1	2	--	3	--	--	3	1	2
C06	1	2	3	1	1	--	1	1	1	1	--	--	3	1	1
Average	1.8	1.8	3	1.2	1.25	2.3	1.3	1.5	1	1.8			3	1.3	1.3

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

LIST OF ASSIGNMENTS

1. General Arrangement plan
2. Calculation of Load Distribution, Shear force and Bending moment
3. Scantling Calculation for various structural members
4. Section modulus calculation of ship
5. Midship section drawing
6. Estimation of Light weight and Dead weight of ship

Total : 60 Hours

TEXT BOOKS

1. Robert Taggard, ship design & construction, The society of naval architecture & marine engineers,1980
2. Eric c.tupper, Introduction to naval architecture, reed Elsevier India pvt lmt,2010

REFERENCE BOOKS: 1. Principle of naval architecture, vol I	
Designed by	" Department of Naval Architecture & Offshore Engineering "

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code UCNA5PB	Course Name: SOFTWARE LABORATORY - II	**L** 0	**T** 0	**P** 2	**C** 1
Year and Semester	III Year (Vth Semester)	Contact hours per week (2 Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	To learn the initial ship design procedure using the given design software	
Course Outcome	At the end of the course the student should be able to:	
	1	Prepare initial modeling techniques available in the Software

	2	Calculate hydrostatic particulars
	3	Design hull structure (scantling)
	4	Perform the area calculation
	5	Generate surface of the given model using appropriate tools available in the Software
	6	Develop Hull form hydrostatics curves

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
CO1	2	2	2	2	-	-	-	-	2	2	1	-	1	2	2
CO2	2	2	1	-	-	-	-	-	2	2	1	-	1	2	2
CO3	2	2	1	-	-	-	-	-	3	2	1	-	1	2	2
CO4	2	2	1	-	-	-	-	-	2	2	1	-	1	2	2
C05	2	2	1	-	-	-	-	-	3	2	1	-	1	2	2
C06	2	2	1	-	-	-	-	-	3	2	1	-	1	2	2
Average	2	2	1.1	2					2.5	2	1		1	2	2

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

CONTENTS

Introduction-Basics- Creating Design and Defining-Basic Curves-Creating Control Curves-Creating A Surface – Outputting the surface – Curve Fairing

Hydrostatic- Introduction Basics- Performing Fundamental Calculations

Introduction to Hull Structural Design

Total : 30 Hours

REFERENCES

1. Software Manual	
Designed by	" Department of Naval Architecture & Offshore Engineering "

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code UBNS5PB	Course Name: SEAMANSHIP LABORATORY	**L** 0	**T** 0	**P** 2	**C** 1
Year and Semester	III Year (Vth Semester)	Contact hours per week (2Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*The aim to give the students an idea on different ship handling equipments by visiting Shipyard or Ship*	
Course Outcome	At the end of the course the students should be able to	
	1	Distinguish the different ship handling equipments and the position of each equipments
	2	Identify Location of various tanks and their usage

	3	Infer piping, electrical and HVAC systems
	4	To Understand access arrangements inside the ship
	5	To understand the mooring arrangements on the ship
	6	Use the knowledge gained in the shipyard

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
CO1	-	-	2	-	1	1	2	1	1	2	2	2	2	2	2
CO2	-	-	2	-	1	1	2	1	1	2	2	2	2	2	2
CO3	-	-	-	-	1	1	2	1	1	2	2	2	2	2	2
CO4	-	-	2	-	1	1	2	1	1	2	2	2	2	2	2
C05	-	-	2	-	1	1	2	1	1	2	2	2	2	2	2
C06	-	-	1	1	1	-	-	1	3	2	2	1	1	2	3
Average	0	0	1.8	1.0	1.0	1.0	2.0	1.0	1.3	2.0	2.0	1.8	1.8	2.0	2.2
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

The student shall be taken to visit a ship and they have to understand the following:

1. Various Decks.
2. All the equipment fitted on the deck (like windlass, capstan, winches, cranes, bitts Bollard 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 area
7. Equipments used for anchoring and mooring (Ground tackle equipments like anchor, anchor chain, wire rope, shackles, chain shoppers) chain lockers etc.
8. Bulwark and guard rail.
9. Communication equipments
10. Fendering
11. Cargo holds
12. Doors and hatches.
13. Bulk heads.
14. Wheel house.
15. Masts, top light, range light.

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 : 30 Hours

REFERENCES

1. Manual

Designed by	"Department of Naval Architecture & Offshore Engineering "

SEMESTER – VI

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	**L**	**T**	**P**	**C**
UCNA601	SEAKEEPING AND MANEUVERING OF SHIPS	4	0	0	4
Year and Semester	III Year (VI Semester)	Contact hours per week (4Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To understand the motion characteristics in waves and to evaluate the steering features of surface ships in calm waters*
Course Outcome	Students will be able to

	1	Carry out analytically the Seakeeping analysis for 1-DOF
	2	Estimate the ship response spectrum in random waves
	3	Estimate the control fixed stability of surface ships.
	4	Analyze the behaviour of linear hydrodynamic derivatives in maneuvering
	5	Practice standard manoeuvers and experiments for determining the hydrodynamic derivatives
	6	Explain the hydrodynamics associated with rudder selection and its design aspect

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	2	-	2	2	3	2	1	2	2	2	-	-	2	2
CO2	2	2	2	2	2	1	-	-	2	2	2	-	2	2	2
CO3	2	2	2	2	2	1	-	-	2	2	2	-	2	2	2
CO4	2	2	2	2	2	2	2	2	2	2	2	-	2	2	2
C05	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
C06	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2
Average	1.8	2.0	1.7	2.0	2.0	1.7	1.3	1.2	2.0	2.0	2.0	0.7	1.7	2.0	2.0
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I – MARINE ENVIRONMENT

Regular surface waves and their properties, Irregular Waves – statistical representation, Sea State spectrum, Beaufort scale. Introduction to seakeeping, Ship in waves, Frequency of encounter

UNIT II – MOTION CHARACTERISTICS IN REGULAR WAVES

Ship motions in regular waves – Heave, Pitch and Roll - Equations of motion (uncoupled), Dynamic response curve, Determination of hydrodynamic coefficients using Strip theory – added mass and damping coefficients, coupled motions – heave and pitch

UNIT III - MOTION CHARACTERISTICS IN IRREGULAR WAVES AND DYNAMIC EFFECTS

Ship motions in irregular waves, Response spectra, Dynamic effects; deck wetness, slamming, relative motions, sea sickness, Added resistance and loss of ship speed in seaway, Design considerations for seakeeping, Motion stabilizers.

UNIT IV – MANEUVERING CHARACTERISTICS OF SURFACE SHIP

Introduction to maneuverability, Types of directional stability, linear equations of motions in horizontal plane, hydrodynamic and control derivatives, stability index, standard maneuvers; turning circle, zigzag, pull-out and spiral maneuvers, heel during turn

UNIT V – MANEUVERING STANDARDS AND RUDDER CHARACTERISTICS

Experimental determination of hydrodynamic derivatives; straight-line, rotating arm and PMM experiments, IMO maneuvering standards, Maneuvering in shallow water; Squat, Bank Cushion effect, Interaction between ships**,** Control surface geometry, Rudder types and characteristics, Hydrodynamic constraints in rudder design.

Total : 60 Hours

TEXT BOOKS

1. Dynamics of Marine Vehicles, R Bhattacharya, 1978
2. Principles of Naval Architecture, Vol III, edited by Edward V Lewis

REFERENCES

1. Introduction in Ship Hydrodynamics, by J M J Journee & Jacob Pinkster, Delft University of Technology
2. Seakeeping : Ship Behaviour in Rough Weather , by A R J M Lloyd

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA602	STRUCTURAL DESIGN OF SHIPS	4	0	0	4
Year and Semester	III Year (VI Semester)	Contact hours per week (4Hrs)			
Prerequisite course	NIL				

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To be able to undertake various structural design processes by understanding the function and requirements of various structural components and its features*	
Course Outcome	Students will be able	
	1	Describe the design process and various steps in designing of hull structure

	2	Analyze the ship structure under various loading conditions
	3	Design process for decks, bulkheads & other major structures
	4	Develop plan of framing system, connection details and bilge keel
	5	Calculate scantling of different structural portions
	6	Apply the learned knowledge and methods in the dimensioning of the main structural members and choice of materials for ships.

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	-	-	1	2	1	-	1	1	-	2	-	1	2	2	2
CO2	1	2	2	2	1	-	1	-	-	2	-	1	2	2	2
CO3	2	2	3	2	2	-	1	-	-	2	-	2	2	2	2
CO4	1	1	2	2	1	-	1	-	-	2	-	2	2	2	2
C05	1	1	3	2	2	-	1	-	-	2	-	2	2	2	2
C06	1	1	3	2	2	-	1	-	-	2	-	2	2	2	2
Average	1	1.2	2.3	2	1.5		1	1		2		2	2	2	2
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM)						3. SUBSTANTIAL (HIGH)			

UNIT I – SHIPS STRUCTURAL SYSTEMS

Ship as stiffened plate structure – framing systems, common stiffener sections, corrugated construction, design of strakes (butts, seams), welding sequences, shell expansion; Structural subsystems – break up into bottom structure, side structure, deck structure, bulkhead structure, end structure, superstructure etc., general structural arrangements of different types of ships (historical review); subassembly, stiffened panels and volume sections.

UNIT II –BOTTOM STRUCTURE AND SIDE STRUCTURE

Bottom structure – framing system, functions, single bottom and double bottom construction, structural components and scantlings, openings, cut outs, connection details, bilge keel; Side structure – framing system, functions, structural components and scantlings.

UNIT III – DECKS AND BULKHEADS

Deck structure – functions, framing system, structural components and scantlings, hatch ways, pillars, bulwarks, guard rails, fenders; Bulkhead structure – type of bulkheads, functions, framing

system, structural components and scantlings. Halo Deck Design- Loading calculation for decks, concentrated load considerations

UNIT IV – END STRUCTURES

Fore end structure – functions, structural arrangements (panting), structural components & scantlings; Aft end structure – functions, structural arrangements, structural components & scantlings; Structural connections – compatibility, bottom & side, side & deck, bulkhead with deck, side & bottom

UNIT-5 SCANTLING CALCULATION

Machinery foundations-Design concept, considerations for vibrations, Effectiveness of Superstructure & Deckhouse, structural arrangement, openings & expansion joints, types of mast and its design concept, criticality of cargo hatch design/considerations.

Total : 60 Hours

TEXT BOOKS

1. Ship Design and Construction by Robert Taggart
2. Ship Construction by D.J Eyres
3. Design of Ship Hull Structures by Yausuhisa Okumoto. Yu Takeda &Masaki Mano . Tetsuo Okada

REFERENCES

1. Marine Structural Design by Young Bai

Designed by	"Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA603	SHIP DESIGN - I	3	1	0	4
Year and Semester	III Year (VI Semester)	Contact hours per week (4Hrs)			
Prerequisite course	NIL				

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To understand and apply the various steps involved in the various process for ship hull form design*
Course Outcome	Students will be able to

	1	Define the concept of ship design as an overview
	2	Explain the criteria for selection of various hull form requirements for different ship types
	3	Develop lines plan and general arrangement requirements and solve problems
	4	Do calculations for optimization of existing ship with numerical approach
	5	Select stem and hull forms
	6	Understand the Design procedures and practice for estimating principal dimensions, hull form parameters, lightships and deadweight components

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	1	2	2	1	-	-	-	-	1	-	-	2	2	2
CO2	2	2	3	3	1	-	-	-	-	1	-	-	2	2	2
CO3	2	2	3	3	2	-	-	-	-	1	-	-	2	2	2
CO4	2	2	3	2	2	-	-	-	-	1	-	-	2	2	2
C05	2	3	2	3	2	-	-	-	-	2	-	-	2	2	2
C06	2	3	2	3	2	-	-		-	2	-	-	2	2	2
Average	1.8	2.1	2.5	2.6	1.6					1.3			2.0	2.0	2.0
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I - ENGINEERING DESIGN PHILOSOPHY

Ship design as a science and as an art, marketing manufacturing and operational considerations in Ship design, Technological, economic and sociological factors and national priorities.

UNIT II - DESIGN CONSIDERATION TO SHIPS

Owner’s requirements, shipyard production facilities and operational constraints to be considered in the design process, Introduction to ship design method using basic ship or parent ship types, ship design as an iterative process and stages of ship design, the design spiral.

UNIT III - ESTIMATION OF WEIGHT AND VOLUME COMPONENTS

Preliminary GA drawing and requirements on board, Weight and capacity equations and their use in ship design, use of cubic equation, Calculation of weight and volume components using parent ship

data or other compiled data. Calculation of steel, wood, outfit and machinery weights, using formulas, Estimation of dead weight components, design of hull form from first principles

UNIT IV - DESIGN OF HULL FORM

Selection of main dimensions - Initial Sizing, Selection of Length, Slenderness Coefficient, Selection of Other Main Dimensions, Selection of Beam, Selection of the Side Depth, Selection of the Draft, Selection of Hull Form Coefficients, Midship Section Coefficient, Waterplane Area Coefficient, Determination of the main dimensions – Methods

UNIT V - STEM AND STERN HULL FORMS

Distribution of Displacement; Sectional Area Curve and factors affecting sectional area curve. Form of Section Shape, Form of midship section, Bow section below and above waterline, stern form below and above waterline, Form of bow; type of bow, bulbous bow, parabolic bow, Form of stern; Elliptical, Cruiser Stern, Transom Stern

Total: 60 Hours

TEXT BOOKS

1. Ship Design Methodologies of Preliminary Design by Apostolos Papanikolaou
2. Practical Ship Design by D.G.M Watson
3. Ship Design for Efficiency and Economy by H. Schneekluth and V. Bertram
4. Ship Design and Construction by R.Taggart

REFERENCES

1. Basic Ship Theory, Vol.1 & 2 by K.J.Rawson and E.C.Tupper
2. Principles of Naval Architecture, Vol. 1,2&3 by Ed.V. Lewis

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA604	SHIP SYSTEMS DESIGN	3	0	0	3

Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)
Prerequisite course	NIL	

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To understand and prepare the components of various Ship Systems and their arrangements*	
Course Outcome	Students will be able to	

	1	Describe the components involved in different Ship systems
	2	Distinguish the hull systems and their arrangements
	3	Design Propulsion and Steering systems
	4	Construct and evaluate the performance of electrical system
	5	Illustrate and explain different engineering systems
	6	Solve a design task of various systems contains in the ship

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	1	3	3	2	-	1	1	-	2	1	1	2	2	2
CO2	-	-	2	2	2	-	1	1	-	2	-	1	2	2	2
CO3	1	1	3	3	2	-	1	1	-	2	1	1	2	2	2
CO4	1	1	2	2	2	-	1	1	-	2	-	1	2	2	2
C05	1	1	2	2	2	-	1	1	-	2	-	1	2	2	2
C06	2	2	3	3	2	-	1	1	-	2	1	1	2	2	2
Average	1	1	2.5	2.5	2	-	1	1	-	2	0.5	1	2	2	2
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM)					3. SUBSTANTIAL (HIGH)				

UNIT I - INTRODUCTION TO SHIP SYSTEMS

Ship systems- piping system- HVAC system- pneumatic system- hydraulic system- pumping system- navigation system- installation details of prime movers and alternators- refrigerators- tackles- rigging system- line and schematic diagram- components of ship systems, pressure ratings

- Piping system- different types of piping system, pipe color coding, valves and functions
- HVAC- Heat ventilation & air conditioning system, types of coolants, insulations, Flow measurements, Heat Load, Air changes
- Pneumatic and hydraulic system- basic function, types of valves, pneumatic/hydraulic system hygiene
- Navigation equipment – navigation lights, GPS, gyro compass, navigation working system, wave guides, EMI/EMC, EMI Bonding, EMI Shielding.

UNIT II – HULL SYSTEMS

Fire Fighting Appliance (FFA) – life saving appliances (LSA)- fresh water system, - RO plant , Sanitary system- sewage treatment plant (STP)- - deck drains- ballast system- anchor wash system- deck equipments- anchor handling system- cargo handling equipments, Boat Davits, Roll stabilizers, Deck cranes/derricks, anchor cables arrangement.

- FFA- CO_2, freshwater system, seawater system, emergency alarm & smoke detector
- LSA - types of life boats, buoys, life rafts
- FWS – RO plant, hydrophone tank

UNIT III - ENGINEERING SYSTEMS

Fuel oil system- lubrication oil system- starting air system- compressed air system- exhaust system- fire main system- CO_2 system- bilge system- sludge system,- deck sprinkler,- boiler system- jacket cooling system- oil filters/strainers system- oily water separator- scavenging and turbo charger system- Anti-vibration system- Types of machinery Shock mounts, Engine exhaust system. Engine Room Ventilation System, Chilled water System

UNIT IV – ELECTRICAL SYSTEMS

Power generation distributor (PGD)- Main switch board, breakers- communication system- Voice pipe, Engine room Telegraph, MCR/ECR machinery performance/monitoring indicator system, , navigation system- lighting system- AC & DC system- earthed and insulated power system- Emergency supplies- dynamic positioning system, AIO/ IOs

UNIT V - PROPULSION AND STEERING SYSTEM

Conventional propulsion system (Prime mover to Propeller including Thrust Block plumber block Gear Box etc.) Electrical propulsion- diesel propulsion system – CODOG, CODAG- power flow schematic- single line layout- steering gear system- stern tube bearing- oil lubricated stern tubes- controllable pitch propeller- thrusters, Active rudder, Steering gear system

Total : 45 Hours

TEXT BOOKS

1. G.O.Watson, Marine Electrical Practice,Butterworth Heineman, 1990
2. Harrington L.Roy, Marine Engineering, SNAME Publications, 1992
3. Chirstopher Lavers and Edmund G.R. Kraal, Reed's Vol.7, Advanced Electro technology for marine engineers, 2014

REFERENCES

1. E. A. Fernandez, Marine Electrical Technology, 2014

2. Mukund R. Patel, Electrical Power Systems, , 2012

3. Generation, Transmission and Utilisation of Electrical Power, A.T. Starr, 1957

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA605	DYNAMICS OF OFFSHORE STRUCTURES	3	0	0	3

Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)
Prerequisite course	NIL	

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To provide fundamental knowledge of structural modelling and mathematical methods needed to analyze offshore and coastal structures*

Course Outcome	Students will be able to	
	1	Formulate a structural model and natural forces imposed by the ocean environment.
	2	Apply the stiffness method to analyze beams, trusses, and frames
	3	Calculate wave forces on Offshore Structures
	4	Evaluate structural response of the structure in irregular seas
	5	Evaluate the response of single degree of freedom system by using different numerical methods (eg: Newmark-B method, Runge Kutta method)
	6	Apply structural dynamics to marine structures

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	2	2	2	2	1	-	2	1	-	2	-	1	2	2	2
CO2	2	2	2	2	2	-	2	1	-	2	-	1	2	2	2
CO3	3	3	2	2	2	-	2	1	-	2	-	1	2	2	3
CO4	2	2	2	2	2	-	2	1	-	2	-	1	3	2	3
C05	2	3	2	2	2	-	1	1	-	2	-	1	2	2	2
C06	3	3	2	3	2	-	1	1	-	2	-	1	2	2	3
Avg.	2.3	2.5	2	2.1	1.8	-	1.6	1		2		1	2.1	2	2.5
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I - EFFECT OF ENVIRONMENT ON OCEAN STRUCTURES

Introduction to different types of ocean structures - Development of structural forms for deep and ultra-deep waters - Environmental forces - Structural action of ocean structures

UNIT II – SINGLE DEGREE OF FREEDOM SYSTEMS

Characteristics of single degree-of-freedom model - Methods of writing equation of motion: comparison of methods - Free and forced vibration of single degree-of-freedom systems - Undamped and damped systems - Formulation of equation of motion - Examples - Coulomb damping - Comparison of damped and undamped forced vibration -response build up. Estimate of damping: Classical damping, Rayleigh and Caughey - Damping by mode superposition - Numerical problems in single degree-of-freedom systems - Two degrees-of freedom systems - Formulation of equation of motion

UNIT III - MULTI DEGREE OF FREEDOM SYSTEM

Eigenvalues and eigenvectors - Orthogonality of modes - Study of multi degrees-of-freedom systems - Equations of motion - Natural frequencies and mode shapes - Stodola, Rayleigh-Ritz and influence coefficient methods, Dunkerley - Matrix methods for dynamic analysis – Modal response method - Modal mass contribution - Example problems - Duhamel's integrals

UNIT IV - APPLICATION OF STRUCTURAL DYNAMICS TO MARINE STRUCTURES

Application of structural dynamics to offshore structural problem, Fluid-structure interaction – Dynamic response analysis of offshore jacket platforms, Articulated Tower, response control by Tuned mass damper, or viscous damper, Development of Tension Leg Platforms and geometric optimization - Dynamic analyses of TLPs involving generation of Mass, stiffness and damping matrices of TLP from first principles.

UNIT V - DYNAMIC ANALYSIS METHODOLOGY

Numerical evaluation of response of SDOF a using Newmark-B method, Runge Kutta method

Total : 45 Hours

TEXT BOOKS

1. Anil K. Chopra. 2003. Dynamics of structures: Theory and applications to earthquake Engineering: Pearson Education, Singapore

2. Clough and Penzien, Dynamics of Offshore Structure; Computers and structures, Inc

3. Arvid Naess and Torgeir MOan. 2013. Stochastic dynamics of marine structures, Cambridge University Press, New York, USA

REFERENCES

1. Chakrabarti, S. K. 1987. Hydrodynamics of Offshore Structures: Computational Mechanics.

2. Chakrabarti, S. K. 1990. Non-linear method in offshore engineering, Elsevier Science Publisher, The Netherlands.

3. Chakrabarti, S. K. 1994.Offshore Structure Modelling: World Scientific.

4. Clauss, G. T. et al. 1992. Offshore Structures, Vol 1 - Conceptual Design and Hydromechanics: Springer, London.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA606	Course Name: INTRODUCTION TO FINITE ELEMENT ANALYSIS	**L** 3	**T** 0	**P** 0	**C** 3
Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To attain a foundation in finite element method and to study the basic methods to solve the fundamental structural problems*	
Course Outcome	Students will be able to	
	1	Understand the basics of structure types, loads and analysis

	2	Solve the problem of Bar and Truss
	3	Analyze the beam and frame problems
	4	Understand the various study of plate problems
	5	Implement and understand the basics of integration
	6	Inculcate the usage of finite element tool in the area of solid mechanics in general

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	3	-	-	2	-	-	1	-	2	-	1	1	1	3
CO2	3	3	-	-	2	-	-	1	-	2	-	1	1	1	3
CO3	3	3	-	-	2	-	-	1	-	2	-	1	1	1	3
CO4	2	2	-	-	2	-	-	1	-	2	-	1	1	1	2
C05	3	2	-	-	2	-	-	1	-	2	-	1	1	1	2
C06	3	3	-	-	2	-	-	1	-	2	-	1	1	1	2
Avera	2.8	2.6			2			1		2		1	1	1	2.5
CORRELATION LEVELS			1. SLIGHT (LOW)					2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I – BASICS OF STRUCTURE AND LOADS

Introduction to Matrix operations; Introduction to redundant structures; 1D, 2D and 3D structures - Bar, Beam, Shaft, Plate & Shells; Types of loads.

UNIT II – BAR ELEMENT AND NUMERICAL TECHNIQUES

Bar and Truss problems; Numerical technique for structural problem – Finite difference method, Finite element method, Finite strip method

UNIT III – BEAM AND FRAME ELEMENT

Beam & Frame Element; Shape functions

UNIT IV – PLATE ANALYSIS

FEA of plates – Plane stress element (constant strain element), Plate bending (four nodded element) and Iso-parametric element.

UNIT V: NUMERICAL INTEGRATION

Numerical integration-Newton-Cotes rules, Trapezium rule, Simpson’s rule, Error term, Gauss-Legendre rules, Changing limits of integration, Gauss-Leguerre rule.

Total : 45 Hours

TEXT BOOKS

2. Bhatti, M.A., Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Wiley, 2005.
3. Reddy, J. N., An Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill Science/Engineering/Math, 2005.
4. Logan D. L., A First Course in the Finite Element Method, Thomson- Engineering, 3rd edition, 2001.

REFERENCES

1. Chandrupatla T. R., and Belegundu, A. D., Introduction to Finite Elements in Engineering, Prentice Hall, 2003.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA607	TECHNICAL ASPECTS OF SHIP HANDLING IN PORTS AND HARBOURS	3	0	0	3
Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objectives	*To study the different methods and factors affecting Ship Handling in Port and Harbour regions*	
Course Outcome	Students will be able to	
	1	Explain the basic maneuvering principles applicable in restricted waters
	2	Express the different methods of berthing/unberthing and towing procedures
	3	Choose mooring and anchoring systems.
	4	Propose docking plan and stability requirement
	5	Explain different ship handling procedure
	6	Solve the ship handling problems in ports and harbors

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	-	-	1	1	2	1	-	-	-	2	-	1	1	2	2
CO2	-	-	2	2	1	1	1	-	-	2	-	1	2	1	2
CO3	-	-	2	2	1	1	1	1	-	2	-	1	2	1	2
CO4	-	-	2	2	1	1	1	1	-	2	-	1	2	1	2
C05	-	-	2	2	2	1	1	1	-	2	1	1	2	1	2
C06	-	-	2	2	2	1	1	1	-	2	1	1	2	1	2
Avg			1.8	1.8	1.5	1	1	1		2	1	1	1.8	1.1	2
CORRELATION LEVELS			1. SLIGHT (LOW)					2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I - BASIC MANEUVERING PRINCIPLES IN PORTS AND HARBOURS

Harbour and Port Infrastructure, Design aspects of harbours and ports, Basic Ship Manoeuvring principles, Factors affecting the maneuvering characteristics, Stopping ability, Factors affecting the stopping ability, Crash Stop, Ship turning characteristics, Factors affecting the turning

UNIT II - SHIP HANDLING IN RESTRICTED WATERS

Concept of Pivot point in Ship handling, Transvers trust, Vessel movement with alternative propeller systems, Ship turning in restricted waters, Different procedures for berthing the ship, Unberthing of ships, Ship entering the dock.

UNIT III – TOWING OPERATIONS

Shallow water effects, Squat and affecting factors, Interaction effects – Bank Cushion effect, Interaction between vessels, Operations with Tugs, Types of Tugs, Girting the Tug, Bollard Pull, Towing of ships – estimation of required tow force. Towing equipments

UNIT IV – MOORING AND ANCHORING OF VESSELS

Mooring arrangement, Anchoring Principles, Environmental loads on moored or anchored vessels, Mooring of ships to a quay, jetty or dolphin, Mooring to Buoys, Mooring and anchoring equipment in ports

UNIT V – DOCKING OF SHIPS

Floating docks, caisson dock gates and falling leaf type flap gates, Dry docks and docking of a ship – loads on blocks; trim and stability during docking

Total : 45 Hours

TEXT BOOKS

1. Ship Handling: Theory and Practice, David J House, Elsevier, 2007
2. Advanced Ship Handling, Per-Ake Kvick, 2012
3. Anchor Practice – A Guide for Industry, David J House, Witherby, 2001.

REFERENCES

1. The Complete Book if Anchoring and Mooring, Earl R Hinz, Cornell Maritime Press, 1986
2. Dry Docking and Shipboard Maintenance, David J House, Witherby, 2003.
3. Working with Tugs, Alan Palmer, Steamship Mutual, 2008

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA608	COST ESTIMATION AND TENDERING FOR SHIP BUILDING AND ALIED INDUSTRY	3	0	0	3

Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)
Prerequisite course	NIL	

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objectives	1. Awareness of cost estimation of ship building 2. Student should have an understanding about the managements concepts

	3. Learn about the ISO certifications and management practices in the ship building industry
Course Outcome	Students will be able to
	1 Estimate the cost of the ship building
	2 Evaluate the chartering methods based on design
	3 Understand the management concepts.
	4 Analyse the economics requirements in ship building
	5 Illustrate the Port safety codes
	6 Develop the concepts of Management based skills

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	-	-	1	1	2	1	-	-	-	2	-	1	1	2	2
CO2	-	-	2	2	1	1	1	-	-	2	-	1	2	1	2
CO3	-	-	2	2	1	1	1	1	-	2	-	1	2	1	2
CO4	-	-	2	2	1	1	1	1	-	2	-	1	2	1	2
C05	-	-	2	2	2	1	1	1	-	2	1	1	2	1	2
C06	-	-	2	2	2	1	1	1	-	2	1	1	2	1	2
Average			1.8	1.8	1.5	1	1	1		2	1	1	1.8	1.1	2
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I- Cost Estimation

Shipbuilding cost estimation. Tendering and contracts. Freight market and operating economics.

UNIT II- Chartering of Sips

Chartering of ships. Alternative maritime designs. Overall optimization for speed size Combinations of ships

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UNIT III- Economics

Relative importance of technical and economic features. Importance and use of ICT in maritime designs.

UNIT IV- Safety Management

Safety management concept in ships and ports and ISO certifications.

UNIT V- Management Practices

Management practices in maritime projects. Commercial, marketing, legal and financial aspects of shipbuilding and shipping

Total : 45 Hours

Text Books:

1. NAVSEA 2005 Cost Estimating Handbook
2. National construction estimator
3. Cost estimating Rodney D Stewart

References:

1. NAVSEAINST 7300.14B, Classification of Cost Estimates for Ships and Repair Availabilities
2. Joint Fleet Maintenance Manual (JFMM)

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA609	FUNDAMENTALS OF SUBSEA ENGINEERING	3	0	0	3
Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objectives	*To introduce the principles of subsea engineering in the context of the hydrocarbon exploration and to understand the procedure involved in design, construction, installation and control of Sub-Sea systems*	
Course Outcome	Students will be able to	
	1	Identify the main components of subsea field architecture.
	2	Monitor the installation, operation and control of subsea equipment
	3	Adapt knowledge on future scope and challenges in Sub-Sea engineering
	4	Make layout of Sub-Sea systems and support systems
	5	Evaluate subsea installation and intervention methods
	6	Interpret a subsea production system

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	-	-	1	1	2	1	-	-	-	2	-	1	1	2	2
CO2	-	-	2	2	1	1	1	-	-	2	-	1	2	1	2
CO3	-	-	2	2	1	1	1	1	-	2	-	1	2	1	2
CO4	-	-	2	2	1	1	1	1	-	2	-	1	2	1	2
C05	-	-	2	2	2	1	1	1	-	2	1	1	2	1	2
C06	-	-	2	2	2	1	1	1	-	2	1	1	2	1	2
Average			1.8	1.8	1.5	1	1	1		2	1	1	1.8	1.1	2
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM)						3. SUBSTANTIAL (HIGH)			

UNIT I - INTRODUCTION TO SUB SEA ENGINEERING

Introduction to oil and gas industry: general view of oil and gas industry. Sea and subsea environment, Introduction to offshore oil and gas exploration methods, Overview of Deepwater developments: introduction, deep-water areas and potential, challenges. Metocean and environmental conditions, the influence of wave, wind, tide and current on marine operations, Existing Subsea Facilities

UNIT II - SUBSEA PRODUCTION SYSTEM

Major components of the subsea production system- Subsea Production Tree, Plugs, Pipeline and Flow line, Subsea manifold, Umbilical, Host Facility, Termination Unit, Production risers, Template and Jumpers.

UNIT III - SUBSEA STRUCTURES AND ARCHITECTURE

Different lay outs of Sub-Sea systems, Description of each of the pieces of the subsea infrastructure, Deep Offshore Drilling and Cementing: Procedures, equipment, rig hydraulics, casing support systems.

UNIT IV - SUBSEA OPERATION AND CONTROL

Subsea processing, subsea control systems- components required to operate a subsea system- Down Hole Valves, Down Hole Pressure & temperature Transmitters, Subsea Tree Valves, Subsea Tree instrumentation Subsea Manifold/flowline Instrumentation, Power Supplies, Hydraulic Supplies, Programmable Controllers ,Subsea Control Equipment, Direct Hydraulic, Electro Hydraulic Control System ,Multiplexed hydraulic Control System; Well Testing, Flow assurance in subsea design and configuration.

UNIT V - SUBSEA INSTALLATION AND INTERVENTION

Installation Methods- Overview of the installation of subsea plant, risers and Offshore pipelines, tankers, offshore separation facilities and storage and the main intervention methods including AUVs, ROVs and divers; Subsea Monitoring System, Sub-Sea challenges, Field Economics and Future Challenges.

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Total : 45 Hours

TEXT BOOKS

1. Bai Young and Qiang Bai, 2010, Subsea Engineering Handbook, Elsevier, 910 pp

2. Bai, Y and Bai, Q. (2005). *Subsea Pipelines and Risers*. I Edition. Elsevier.

3. Chakraborty S.K.: Handbook of offshore engineering volume I & II 3 IADC deepwater control guidelines.

4. James G. Speight, 2014, Handbook of Offshore Oil and Gas Operations, Gulf Professional Publishing, 428 pp

REFERENCES

1. Construction of Offshore and Marine Structures - Ben C. Gerwick, Jr.
2. An Introduction to Offshore Engineering - Angus Mather
3. Rabia H.1995; Well Engineering and Construction. 640 pp.
4. Mitchel Robert L (Editor), Drilling Engineering. V 2, 2007, In Lake L W (Editor) Petroleum Engineering Handbook, SPE International, 770 pp.

Designed by	" Department of Naval Architecture & Offshore Engineering "

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UBMEC02	MARINE ENGINEERING - II	3	0	0	3
Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				

Course Category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*The students would learn the details regarding marine pumps, thermal and power transmission systems and the principle behind marine refrigeration*	
Course Outcome	Students will be able to	
	1	Identify the different pump system in ships and their arrangements
	2	Explain the method of power transmission and marine refrigeration
	3	Recommend suitable thermal system
	4	Illustrate Power transmission system
	5	Analyze the performance of marine refrigeration system
	6	Identify and analyze the power systems and associated auxiliary systems (e.g. propulsion, refrigeration, and air conditioning) in support of the maritime sector.

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	-	-	1	1	2	-	1	1	-	2	-	1	1	2	2
CO2	-	-	-	1	2	-	1	1	-	2	-	1	1	2	2
CO3	-	-	-	1	2	-	1	1	-	2	-	1	1	2	2
CO4	-	-	-	1	2	-	1	2	1	2	-	1	1	2	2
C05	1	1	-	-	2	-	1	2	-	2	-	2	1	2	2
C06	1	1		1	2		1	2	1	2		1	1	2	2
Average	0.3	0.3	0.2	0.8	2		1	1.5	0.3	2		1.1	1	2	2
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I - MARINE PUMPS, PIPES AND VALVES

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, types used in Marine Practice. Materials and corrosion in pipes- color codes for pipes.

UNIT II - MARINE THERMAL SYSTEM

Aux 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 clarities: Bilge and Ballast systems - sewage disposal, Oily water separator, incinerator, galley equipments

UNIT III - STRUCTURAL COMPONENTS OF SHIPS

Deck machine and hull equipment - mooring, anchor handling, cargo handling -dry Cargo handling equipment - winches, cranes, Cargo gear, 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 thruster.

UNIT IV - POWER TRANSMISSION SYSTEM

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 - MARINE REFRIGERATION

Safety systems- firefighting equipment Instrumentation & Control, watch keeping system UMS classes, Air Compressors, heat exchanger, Refrigeration - Definition and purpose - Principle of operation of Simple vapor 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 vapor compression system, Principle of operation of vapor 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, Freon’s etc. Factors influencing selection of refrigerants - Secondary refrigerants

Total : 45 Hours

TEXT BOOKS

1. Harrington; Marine Engineering, SNAME Publications,
2. Pounder C.C; Marine Diesel Engines, Newten - Butterworths, London.Khetagurov, M;
3. Marine Auxiliary Machinery and systems, Peace Publishers, Moscow.

4. Taylor, D.A.; Introduction to Marine Engineering 5. Reed's Marine Engineering for Naval Architect	
Designed by	" Department of Marine Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA6PA	SHIP DESIGN CALCULATION DRAWING & DRAFTING - IV (SDCADD - IV)	0	0	4	2
Year and Semester	III Year (VI Semester)	Contact hours per week (4Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	

	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	1. To study & perform hydrodynamic calculations in ship 2. To study the behavior of Propeller & Rudder in various condition 3. To understand the importance of the Floodable length calculation in a ship	
Course Outcome	Students will be able to	
	1	Estimate the resistance of a ship for various speeds
	2	Examine the powering based on Model testing
	3	Develop the efficiency of the propeller in various conditions
	4	Design the rudder based on its Maneuvering behavior
	5	Evaluate the number of bulkheads required based on floodable calculation
	6	Understand the behavior of ship in various sea conditions

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1.0	1.0	-	-	1.0	-	2.0	3.0	1.0	2.0	1.0	1.0	-	2.0	1.0
CO2	3.0	2.0	1.0	-	2.0	1.0	1.0	1.0	-	-	2.0	-	-	3.0	1.0
CO3	3.0	2.0	2.0	-	2.0	1.0	1.0	1.0	-	-	2.0	-	1.0	3.0	1.0
CO4	2.0	2.0	1.0	-	1.0	1.0	-	2.0	1.0	2.0	2.0	-	2.0	3.0	-
C05	2.0	2.0	1.0	1.0	1.0	2.0	-	-	1.0	2.0	3.0	1.0	-	3.0	2.0
C06	3.0	2.0	1.0	2.0	3.0	2.0	1.0	1.0	1.0	3.0	2.0	2.0	-	3.0	1.0
Avg.	2.3	1.8	1.0	0.5	1.7	1.2	0.8	1.2	0.7	1.5	2.0	0.7	0.5	2.8	1.0

LIST OF ASSIGNMENTS

1. Resistance calculation for various speeds using Theoretical method.
2. Extrapolation method of Resistance & powering from model to ship.
3. Estimation of propeller efficiency for the selection of Engine
4. Design of Rudder
5. Sea keeping calculations
6. Floodable length calculations

Total : 60 Hours

TEXT BOOKS

1. Eric c.tupper, Introduction to naval architecture, reed Elsevier India pvt lmt,2010
2. Principle of naval architecture, vol I II & III.

REFERENCE BOOKS:

1. Robert Taggard, ship design & construction, The society of naval architecture & marine engineers,1980

Designed by	"Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UBMECPA	MARINE ENGINEERING LABORATORY	0	0	2	1
Year and Semester	III Year (VI Semester)	Contact hours per week (2Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	

	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To carry out the laboratory to understand various Engine parts, installation and construction details of marine machineries and systems*	
Course Outcome	Students will be able to	
	1	Distinguish the various parts and components in a Marine Engine
	2	Identify and gain knowledge on construction details of generators and compressors
	3	Differentiate different ship handling machineries and equipments on board the ship
	4	Understanding the key features of the piping systems in ships
	5	Understand the mooring arrangements on the ship
	6	Use the knowledge gained observing the Machinery Parts

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	-	-	-	-	1	1	2	1	1	2	2	2	2	2	2
CO2	-	-	-	-	1	1	1	1	-	2	-	1	2	1	2
CO3	-	-	-	-	1	1	2	1	1	2	2	2	2	2	2
CO4	-	-	-	-	1	-	-	-	3	2	1	-	1	2	2
C05	-	-	-	-	1	1	2	1	1	2	2	2	2	2	2
C06	-	-	-	-	1	-	-	1	3	2	2	1	1	2	3
Avg.					1	0.7	1.2	0.8	1.3	2	1.5	1.3	1.7	1.8	2.2

List of Experiments

Main Engine Identification/Construction details of various parts of Main Engine – Cylinders, Cylinder Heads, Pistons, Turbocharger, Governors, Base Plate, Foundation and fitment, Foundation bolts, Chalk fats/steel chalks, Crankshafts, Fly wheels, L O Sump, L O Pump, S W Pump, F W Pump etc.

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.

Identification of construction details ship generator, Installation details of Prime mover, and alternator, MSB parts, Power distribution system, Starting and 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.

A/C and Refrigeration system

Identify the constructional details of Boilers, FW generators, Heat exchangers, Evaporators, Distillers, Hot water, Cooling water and Sea water systems.

Mooring, Anchor handling, Cargo handling equipment, Liquid cargo handling systems, Engine room cranes, Chain blocks, Anchors, Anchor chain cables, Fire Fighting arrangements, Lifesaving equipments

Total : 30 Hours

REFERENCES

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
5. Reed's Marine Engineering for Naval Architect
6. Marine Pumps and Piping Systems.

Designed by	" Department of Marine Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UCNA6PB	SOFTWARE LABORATORY - III	0	0	2	1
Year and Semester	III Year (VI Semester)	Contact hours per week (2Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	

	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To learn the design procedure for the fixed offshore structure using the given design software*	
Course Outcome	Students will be able to	
	1	Create model of the given Jacket platform in software
	2	Analyze the structure under various conditions and loads
	3	Interpret and validate the results

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1.0	1.0	-	-	1.0	-	2.0	3.0	1.0	2.0	1.0	1.0	-	2.0	1.0
CO2	3.0	2.0	1.0	-	2.0	1.0	1.0	1.0	-	-	2.0	-	-	3.0	1.0
CO3	3.0	2.0	2.0	-	2.0	1.0	1.0	1.0	-	-	2.0	-	1.0	3.0	1.0
CO4	2.0	2.0	1.0	-	1.0	1.0	-	2.0	1.0	2.0	2.0	-	2.0	3.0	-
C05	2.0	2.0	1.0	1.0	1.0	2.0	-	-	1.0	2.0	3.0	1.0	-	3.0	2.0
C06	3.0	2.0	1.0	2.0	3.0	2.0	1.0	1.0	1.0	3.0	2.0	2.0	-	3.0	1.0
Avg.	2.3	1.8	1.0	0.5	1.7	1.2	0.8	1.3	0.7	1.5	2.0	0.7	0.5	2.8	1.0
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

Introduction to the Jacket Structure modelling, Creation of sections and materials, Jacket structure generation, Topside structure generation, Modelling and analysis

Total : 30 Hours

REFERENCES

1. Software Manual

Designed by	"Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UBIVCPZ	INDUSTRIAL/SHIPYARD TRAINING	0	0	0	2
Year and Semester	III Year (VI Semester)	Contact hours per week			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To attain a good knowledge on present industrial practices and applying the experience in executing project/design*	
Course Outcome	Students will be able to	
	1	Understand the industry functioning and culture
	2	Relate the class room learning with the industrial approach
	3	Find the correlation between what is taught during the classes and the industry practices
	4	Interpret the procedural aspects of the project being undertaken in the industry
	5	Use the knowledge gained in the classroom-based learning to fulfil the tasks given during the internship
	6	Knowledge obtained through the shipyard

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	1	1	2	-	1	1	2	1	1	2	2	2	2	2	2
CO2	2	2	1	1	1	1	1	2	3	2	1	-	-	2	2
CO3	2	2	1	1	1	1	1	2	3	2	1	-	-	2	2
CO4	-	1	1	1	1	-	-	2	3	2	1	-	-	2	2
C05	2	2	1	1	1	-	-	1	3	2	2	1	1	2	3
C06	2	2	1	1	1	-	-	1	3	2	2	1	1	2	3
Avg.	1.8	1.6	1.1	0.8	1	0.5	07	1.5	2.6	2	1.5	0.7	0.7	2	2.3
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM)					3. SUBSTANTIAL (HIGH)				

GUIDELINES	
▪ Student shall undertake minimum of 3 weeks of internship in any organization related to the field of naval architecture and offshore engineering. ▪ Student shall be evaluated based on the viva voice conducted at the department after completion of the same.	
Designed by	"Department of Naval Architecture & Offshore Engineering"

SEMESTER : VII

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA701	SHIP CONSTRUCTION	L	T	P	C
		3	1	0	4
Year and Semester	IV Year (semester VII)	Contact hours per week (4Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	3. To study the various processes involved in the ship fabrication and construction 4. Knowing the different analysis performed for the pipeline design. 5. Understanding the methods of installation and commissioning needs.			
Course Outcome	After completion of the course, the students will be able to: 1. Explain the various steps involved in the fabrication process 2. Explain various stages and components involved during ship construction 3. Propose suitable storage preparation and pre fabrication procedure 4. Identify Structural components 5. Plan assembly, erection, outfitting, launching, testing and trials 6. Role-play in ship construction procedure			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	3	1	1	2	1	2	2	2	2
CO2	1	1	1	1	3	3	2	1	1	1	2	1	2	2	1
CO3	2	2	1	1	2	1	1	1	-	-	2	-	3	3	2
CO4	2	2	1	1	1	-	1	-	1	2	2	1	2	3	1
CO5	2	2	2	2	1	-	-	1	1	2	2	-	3	3	2
CO6	3	2	3	3	2	-	1	-	1	3	3	-	1	3	1
AVERAGE	1.8	1.7	1.5	1.5	1.7	2.0	1.6	1.0	1.0	2.0	2.0	1.3	2.2	2.7	1.5
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - SHIP BUILDING AND MATERIALS

A typical ship construction program, Building berth, Building Dock, Multi-stage construction methods Equipment used in building berths. Use of Goliath cranes, Floating Docks, Ship types, Shipyard layout, Classification societies, development and application of classification rules, role of statutory bodies, Materials for ship construction, Structural steels, special steels, non- ferrous steels, non-metallic materials, material properties and testing of materials, Joining methods of materials

UNIT II – STORAGE, PREPARATION AND PRE-FABRICATION

Material handling, levelling, preservation and storage, transport system in steel stockyard, material preparation devices- cleaning, marking processes, Process of prefabrication, welding in prefabrication

and erection stages, The cutting process, Mechanical cutting, thermal cutting, optically and numerically controlled cutting, bending of rolled and built-up sections, plate bending. Nesting of plates

UNIT III - FABRICATION OF SUB-ASSEMBLIES, UNITS AND HULL ERECTION

Fabrication of sub-assemblies, flat sections, panels- flat and curved, double bottom sections, side tank units, fore-end and aft end structures, deck and bulkhead structures, Assembly of hull-units, Erection of hull-units on building berth/dock

UNIT IV - SHIP STRUCTURAL COMPONENTS

Functions and details of ship structural components, framing systems, single and double bottom construction, shell and deck plating, bulkheads, pillars, girders and hatch-coaming, machinery casings, super structures and deck- houses. Bow and stern structures, Bossing and struts, bilge keels and fenders

UNIT V – ASSEMBLY, ERECTION, OUTFITTING, LAUNCHING, TESTING AND TRIALS

Various components of outfitting, consisting of systems, equipment and fittings of hull, machinery and electrical groups. Hull Preservation methods, Various outfitting methods, Advanced outfitting, Methods of welding, metallurgy of welding weld defects, distortion and stresses in welds, testing of welds, Inspection and testing during various stages of ship construction, Testing of structures and tanks, Bollard tests and sea trials, Details of launching arrangements.

Practical: Shell Expansion and Nesting of a plate/ Docking Plan and Dry Docking of Ships

Total : 60 Hours

TEXTBOOKS:

1. EYRES,D.J , Ship construction,1994
2. TAYLOR,D.A, Merchant ship construction ,2002
3. KEMP, Ship construction, 2002
4. PURSEY,H.J, Merchant ship construction ,2002

REFERENCES:

1. The Maritime Engineering Reference Book, A Guide to Ship Design, Construction and Operation Editors: Anthony Molland
2. Ship design and construction, Robert Taggart

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA702	Ship Design - II	L	T	P	C
		3	1	0	4
Year and Semester	IV Year (semester VII)	Contact hours per week (4Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	1. To learn about detailed ship design process and understand the functional requirements of ship during design stages			
Course Outcome	After completion of the course, the students will be able to: 1. Develop Capacity plan , Accommodation and other plans with respect to the Statutory Requirements 2. Select machinery and propulsion system 3. Select electrical, navigation and communication equipment as per standards 4. Calculate structural strength as per rules 5. Analyze costing and financial aspects to be taken during ship design process 6. Develop ship drawing and plans and select ship system components			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	1	2	2	2	3	2	2	2	2	3
CO2	2	1	2	2	2	1	1	2	1	2	2	2	2	2	2
CO3	2	1	2	1	2	1	1	2	3	1	2	1	2	2	2
CO4	3	3	3	3	3	2	2	2	1	3	3	3	3	3	3
CO5	2	2	1	1	2	1	1	2	1	1	2	1	2	2	2
CO6	2	2	2	2	2	1	2	2	3	3	2	3	2	2	2
AVERAGE	2.2	1.8	2.2	1.8	2.2	1.2	1.5	2.0	1.8	2.2	2.2	2.0	2.2	2.2	2.3
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - SHIP DRAWINGS AND PLANS

GA Plan, Capacity Plan, Accommodation and other plans, Introduction to rules based design and considerations in ship design, Statutory Requirements, Shipping route, escape plan

UNIT II - MACHINERY SELECTION, INSTALLATION AND PROPULSION SYSTEM

Selection of Main Machinery, Selection of propeller, Selection of Rudder and Steering Gear, Selection of Auxiliary Machinery, Introduction to Ship Systems

UNIT III –BASICS OF ELECTRICAL, NAVIGATION AND COMMUNICATION EQUIPMENT SELECTION

Electrical powering calculations, Sea load, Harbour load, Selection of Generators, Emergency generators, Switch boards, Power distributions, Cabling and other equipments, navigation and communication equipments, lighting requirements in accommodation and other important compartments

UNIT IV - SCANTLING CALCULATION AS PER CLASSIFICATION SOCIETY RULES

Introduction to Class Society rules, Scantling calculation for the given vessel as per particular classification society rule.

UNIT V - COST ESTIMATION

Ship design and Ship building cost - cost of material, machinery and propulsive installation, accommodation/equipment/outfitting, labour and overheads, Tender Document Preparation, TNC, PNC, contract documentation clauses, stage payment, Force Majure, liquidity damage- mandatory document with contract-milestones, stage payment etc.

Total : 60 Hours

TEXTBOOKS:

1. Ship Design Methodologies of Preliminary Design by ApostolosPapanikolaou
2. Practical Ship Design by D.G.M Watson
3. Ship Design for Efficiency and Economy byH. Schneekluth and V. Bertram
4. Ship Design and Construction by R.Taggart
5. Basic Ship Theory, Vol.1 & 2 by K.J.Rawson and E.C.Tupper
6. Principles of Naval Architecture, Vol. 1,2&3 by Ed.V. Lewis

REFERENCES:

1. Design of Ship Hull Structures by YausuhisaOkumoto. Yu Takeda &Masaki Mano . Tetsuo Okada
2. Marine Stuctural Design by Young BaiShip
3. The Maritime Engineering Reference Book, A Guide to Ship Design, Construction and Operation Editors: Anthony Molland
4. Ship design and construction, Robert Taggart

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA703	Corrosion and Protection Engineering	L	T	P	C
		3	0	0	3
Year and Semester	IV Year (semester VII)	Contact hours per week			

Prerequisite course	NIL		(3Hrs)	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	1. To study the various protective coatings, standards and corrosion protection systems			
Course Outcome	After completion of the course, the students will be able to: 1. Select the materials used in marine application 2. Distinguish the various corrosion protection systems 3. Practice the various standards and coating surveys 4. Identify composite materials and its application in marine environment 5. Explain procedures in Non-destructive testing 6. Assess corrosion and choose suitable corrosion protection method in marine industry			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	3	1	1	2	1	2	2	2	2
CO2	2	2	1	1	2	1	1	1	-	-	2	-	3	3	2
CO3	1	1	2	1	1	-	1	3	1	1	2	-	2	2	2
CO4	2	2	1	1	1	-	1	-	1	2	2	1	2	3	1
CO5	2	2	2	2	1	-	-	1	1	2	2	-	3	3	2
CO6	3	2	3	3	2	-	1	-	1	3	3	-	1	3	1
AVERAGE	1.8	1.7	1.7	1.5	1.3	1.0	1.4	1.5	1.0	2.0	2.0	1.5	2.2	2.7	1.7
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - MARINE MATERIALS AND CORROSION BASICS

Different types of materials and their applications in marine environment. Properties and selection of materials for marine environment, Corrosion and corrosion protection methods, Codes of practice for materials in marine environment

UNIT II - PROTECTIVE COATINGS

Protective Coatings – Introduction: Health & Safety, Access Systems, Surface Preparation: Abrasive Blast Cleaning, Health and Safety, Blast Media, Abrasive Blast Cleaning Standards and Quality

Control, Abrasive Blast Cleaner Operational Procedures, Process Control , Paint Types, Paint Application Introduction Health and Safety, Paint Materials, Airless Spray Equipment, Conventional Air Spray Equipment, Plural Component Spray Equipment, Inspection Advancements in Corrosion protection

UNIT III - CORROSION PROTECTION & SURVEY

Cathodic Protection, Design & Construction, Marine PSPC Coating Failure, Metallic Coatings, Concrete, Coating Surveys Paint manufacture: Specialist Coatings ISO and Other International Standards, Quality Management, Paint Testing, Soluble Salts, Fire Protection

UNIT IV - COMPOSITE MATERIALS

Introduction to composites for marine environment

UNIT V - NON-DESTRUCTIVE TESTING

Introduction to Non-destructive testing, Repair and rehabilitation of marine structures, planning guidelines for maintenance of ocean structures, Structural health monitoring of ocean structures

Total : 45 Hours

TEXTBOOKS:

1. Handbook of Corrosion Engineering, Pierre R. Roberge
2. Principles of Corrosion Engineering and Corrosion Control, Zaki Ahmad

REFERENCES:

1. Corrosion and Protection (Engineering Materials and Processes), Einar Bardal
2. NPTEL lectures

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Experimental and Ocean Instrumentation	L	T	P	C
UCNA704		3	1	0	4
Year and Semester	IV Year (semester VII)	Contact hours per week			
Prerequisite course	NIL	(4Hrs)			

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	1. To learn the experimental techniques, different instruments used in ocean engineering and the calibration of various ocean instruments			
Course Outcome	After completion of the course, the students will be able to: 1. Apply the calibration procedure for the instruments used in marine field 2. Define the principles of different acoustic and portable instruments 3. Use various Measurement techniques in marine field 4. Use testing facilities , data acquisition systems and analyze the output 5. Identify the different communication systems and their principles 6. Design and Calibrate Instruments used in marine field			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	3	2	2	2	2	2	1	1	2	2	2	2
CO2	1	1		1	2				1	1	1	-	1	1	1
CO3	2	2	-	3	2	-	1	1	2	3	2	2	2	2	2
CO4	2	2	-	3	2	-	1	1	2	3	2	2	2	2	2
CO5	-	-	2	1		-	2	1	1	1	1	-	2	1	2
CO6	2	2	1	3	2	1	2	1	2	3	2	2	2	2	2
AVERAGE	2.0	1.8	1.3	2.3	2.0	1.5	1.6	1.2	1.7	2.0	1.5	2.0	1.8	1.7	1.8
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - CALIBRATION OF INSTRUMENTS AND ERRORS IN MEASUREMENTS

Measurements and errors, Force transducer Calibration, Pressure transducer calibration, Calibration of Strain gauge, Calibration of accelerometers, calibration of inclinometer, LVDT -Displacement, Calibration of wave probe , Vibration and Flow Calibration.

UNIT II – PORTABLE AND ACOUSTIC INSTRUMENTS

ST meter, STD meter, CTD systems Ocean current meter, Silt meter, In-situ Turbidity meter, Underwater LUX meter, DO & pH meters, and composite types, bottom detection instruments, fish finding, resource estimations, aimed trawling, sub bottom profiling, bottom scanning (side scan sonar), sonar with PPI display, hydrographic echo sounders, and under water position fixing systems

UNIT III - MEASUREMENT TECHNIQUES

Measurement of regular and random waves, measurement of reflectivity and transmissivity, Wave force measurements on cylinders, measurement techniques for Drag and Inertia Forces,

UNIT IV - TESTING FACILITIES AND DATA ACQUISITION SYSTEMS

Hydrodynamic test facilities, Wave makers, Wave absorbers 2-D and 3-D Wave generation, Cavitations tunnel, Tide and Wave telemetering systems, Shipborne Data Acquisition Systems, Marine Meteorological Data Acquisition Systems, ocean data buoys, wave rider buoys

UNIT V - OCEAN COMMUNICATION SYSTEMS

Marine radios and regulations, radar, direction finders, Decca/ Loran systems, satellite position fixing systems, GPS and DGPS, Electronic marine safety instruments: Direction finding floating beacons, EPIRB, equipment for marine surveillance

Total : 60 Hours

TEXTBOOKS:

1. Instrumentation Measurement and Analysis –B.C Nakra and Choudhry
2. Measurement Systems and Applications, Earnest O. Deobelin, McGraw Hill, 1st edn. 1997
3. Instrumentation – Systems and Devices, Rangan & Sharma, Tata McGraw Hill, 1st Edn., 1997

REFERENCES:

1. Instruction Manual for Oceanic Observations, U.S. Naval Oceanographic Office, N.Y., 2001
2. Instrument Methods of Analysis, Willard, Merrit & Dean, C B S Pub., 1st edn., 1992
3. NPTEL Lecture notes

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA705	Small and High Speed Craft Design	L 3	T 1	P 0	C 4
Year and Semester	IV Year (semester VII)	Contact hours per week			

Prerequisite course	NIL		(4Hrs)	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	1. To gain knowledge on various small crafts and high speed vessels, their hull forms and the effect of speed and resistance			
Course Outcome	After completion of the course, the students will be able to: 1. Describe the hull form of high speed crafts 2. Identify the materials used for the hull form of high performance marine vehicles 3. Design of High speed displacement crafts 4. Design of Hydrofoil crafts 5. Evaluate the performance of high speed crafts 6. Interpret the performance of high speed crafts			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	1	1	1	-	2	-	-	2	2	1	2	2	2
CO2	2	2	2	1	2	-	1	2	1	2	2	2	2	2	2
CO3	3	3	3	3	1	2	1	1	-	2	3	2	2	3	2
CO4	3	3	3	3	1	2	1	2	-	2	3	2	2	3	2
CO5	1	1	2	2	2	1	2	1	2	1	2	2	2	2	2
CO6	1	2	2	2	2	1	2	1	2	1	2	2	2	2	2
AVERAGE	1.8	2.2	2.2	2.0	1.5	1.5	1.5	1.4	1.7	1.7	2.3	1.8	2.0	2.3	2.0
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – INTRODUCTION TO HIGH SPEED AND SMALL CRAFTS

Introduction to small crafts, Classification of high performance vehicles, Comparison of vehicles on the basis of power, special design features of high performance vehicles

UNIT II – MATERIALS AND STRUCTURAL COMPONENTS

Materials for high performance marine vehicles, Structural design considerations, Propulsion machinery and propulsion devices

UNIT III – PLANING CRAFTS

High speed displacement craft: design procedures, estimation of power, systems design considerations; Planing craft**:** planing phenomena, estimation of power, hull form design.

UNIT IV – HYDROFOIL CRAFTS

Hydrofoil craft: foil types and configurations, design of foils, stability when foil borne, propulsion considerations.

UNIT V – OTHER HIGH PERFORMANCE VEHICLES

Air cushion vehicles types of air cushion and their effectiveness, cushion sealing arrangements, resistance in calm water and in waves, propulsion

Surface effect ships: High speed catamarans; Wing – in ground effect craft, Hybrid craft

Total : 60 Hours

TEXTBOOKS:

1. Principle of Naval Architecture by Edward V.Lewis, Volume- II
2. Performance by Design: Hydrodynamics for High-Speed Vessels
3. IMO high speed crafts codes

REFERENCES:

1. Principle of Naval Architecture by Edward V.Lewis, Volume- II

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Introduction to Computational Fluid Dynamics	L	T	P	C
UCNA706		3	1	0	4

Year and Semester	IV Year (semester VII)		Contact hours per week	
Prerequisite course	NIL		(4Hrs)	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	1. To gain knowledge on governing equations, discretization, formulation and solution techniques involved in CFD and further learn the applications of CFD in marine industry			
Course Outcome	After completion of the course, the students will be able to: 1. Explain the working principle of CFD – Pre-Processor, Solver and Post-Processor 2. Define the governing equations used in CFD 3. Define partial differential equations (PDE) 4. Develop surface models 5. Apply CFD in Marine Industry 6. Explain finite difference and finite volume method for discretization			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	2	2	2	1	2	2	3	2	2	2
CO2	2	2	2	2	3	-	1	2	-	1	2	2	2	2	2
CO3	2	2	2	2	3	-	1	2	-	1	2	2	2	2	2
CO4	2	2	3	2	3	-	1	2	-	2	3	2	2	3	2
CO5	3	3	2	3	3	2	2	2	1	2	2	3	2	2	2
CO6	3	3	2	3	3	2	2	2	1	2	2	3	2	2	2
AVERAGE	2.5	2.5	2.2	2.5	3.0	2.0	1.5	2.0	1.0	1.7	2.2	2.5	2.0	2.2	2.0
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. UBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION TO CFD CONCEPTS

Introduction to CFD, Working principle of CFD – Pre-Processor, Solver, Post-Processor – problem solving with CFD - models of flow – finite control volume, infinitesimal fluid element – substantial derivative - Reynold's transport theorem

UNIT II - GOVERNING EQUATIONS

Governing equations: conservation principle, mass conservation in three dimension, momentum equation in three dimensions, Navier Stokes equation for a Newtonian fluid – conservative form of the governing equations – integral and differential forms of governing equations - general form of conservation equations

UNIT III - PARTIAL DIFFERENTIAL EQUATIONS (PDE)

Introduction, Classification of partial differential equations, The Eigen value method – Behaviour of PDE's; impact on CFD – hyperbolic, parabolic and elliptic equations – Initial and boundary conditions – Dirichlet and Neumann

UNIT IV - FUNDAMENTALS OF DISCRETIZATION

Discretization concept, discretization techniques – Finite Difference Method, Explicit and implicit approach - Finite Volume Method – Some conceptual basics and illustrations of 1-D steady problem – Basics on solution Algorithms – The SIMPLE algorithm - General errors and uncertainties in CFD simulations – Basics on turbulence modelling

UNIT V - CFD IN MARINE APPLICATIONS

Free surface modelling – interface tracking and interface capturing techniques – Grid independence analysis – CFD in marine applications – Examples; wave pattern calculations for steady ship flow, viscous stern flow calculations, and ship resistance estimation – Recent developments of CFD applications in marine industry, Practical session.

Total : 60 Hours

TEXTBOOKS:

1. Computational Fluid Dynamics: The Basics with Applications, Jr., John D. Anderson 1995.
2. An Introduction to Computational Fluid Dynamics: The Finite Volume Method, H. Versteeg and W. Malalasekera, Printice Hall, Second Edition, 2007

REFERENCES:

1. Best Practice Guidelines for Marine Applications of Computational Fluid Dynamics, WS Atkins Consultants and Members of the NSC, 2003
2. CFD Software manuals for marine applications
3. NPTEL Lectures

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code		L	T	P	C

UCNA707	Submarine Pipeline and Risers	3	1	0	4

Year and Semester	IV Year (semester VII)		Contact hours per week (4Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. To gain knowledge on risers, offshore pipeline design, piping components, piping material take off preparation and installation methods
Course Outcome	After completion of the course, the students will be able to: 1. Explain offshore pipeline and riser configurations 2. Produce design criteria and considerations for offshore pipeline and riser systems 3. Identify the installation methods of pipeline and riser components 4. Monitor pipeline commissioning and operations. 5. Analyze offshore pipeline and risers under various conditions 6. Design various submarine pipelines.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	2	-	2	1	1	1	1	1	2	1	2
CO2	2	2	2	2	1	-	2	2	-		2	2	2	2	2
CO3	2	2	2	2	1	-	2	2	-		2	2	2	2	2
CO4	1	1	2	-	2	-	2	1	1	1	1	1	2	1	2
CO5	3	3	2	3	3	1	2	1	2	2	2	3	2	2	2
CO6	3	3	2	3	3	2	2	2	2	2	2	3	2	2	2
AVERAGE	2.0	2.0	2.0	2.5	2.0	1.5	2.0	1.5	1.5	1.5	1.7	2.0	2.0	1.7	2.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - INTRODUCTION TO SUBMARINE PIPELINES

Introduction Pipeline, offshore pipe line- - Responsibilities of Pipeline Engineer and Designer, Scope of Pipeline -Input and Outputs; Process Diagrams (PFD, P&ID); Codes and Standards for offshore pipeline; Pipeline Elements (Fittings, valves and instruments), Piping material selection. Material Take off for offshore pipelines. Pipeline Drawings (Field layouts, Alignment sheet, Crossing details and Trench details), Plans to be submitted for piping arrangements for classification society approval

UNIT II - PIPELINE DESIGN

General Design Information - Pipeline design procedure- Design Cycle ; Route Selection and Diameter ,Wall Thickness calculation - Internal Pressure, External Pressure, Temperature ;. Hydrodynamic Stability of Pipelines- Horizontal Stability – Weight coating; Vertical Stability – Weight Coating; Pipeline Span - Dynamic Span – Vortex Induced Vibrations and Fatigue; Operating Stresses; Pipeline External Corrosion Protection ; Pipeline Insulation ;. Introduction to Flexible Pipelines; Pipeline Supports and Clamps

UNIT III - SUBMARINE PIPELINE INSTALLATION

Pipeline survey and mapping, Pipeline route engineering; Pipeline Installation Methods.- Lay Barge Methods, S Lay – Shallow Water, J Lay – Deep Water, Reel Barge Method, Float and Sink Method, Bottom Pull Methods. Pipe line towing methods - Below Surface tow, Surface tow (float and Sink), Bottom tow (bottom pull), Off-bottom tow; Installation Bending Stress Control; Pipeline On-Bottom Stability Control

UNIT IV - PIPELINE COMMISSIONING AND OPERATIONS

Pipeline construction for cross country and offshore systems focusing on welding, Pressure testing, pre-commissioning, and commissioning, Pipeline integrity aspects including in-line inspection, Leak detection and emergency planning considerations. Flow assurance; Pigging Operations.

UNIT V - RISER AND DESIGN

Riser – different types of risers ; Riser components, Riser Bends, Riser Clamps; Different riser configurations; riser failure modes; structural riser analysis; static and dynamic riser analyses; riser design criteria and considerations.

Total : 60 Hours

TEXTBOOKS:

1. Offshore Pipelines - By Dr. Boyun Guo -University of Louisiana at Lafayette, Shanhong Song ChevronTexaco Overseas Petroleum Company ,Jacob Chacko, INTEC Engineering, Inc. ,Dr. Ali Ghalambor University of Louisiana at Lafayette.
2. George A. Antaki Piping and Pipeline Engineering: Design, Construction, Maintenance, Integrity, and Repair
3. M L Nayyar, Piping handbook

4. Boyun Guo, Shanhong Song, Jacob Chacko,Ali Ghalambor, Offshore Pipelines
5. Shashi Menon, Piping Calculations Manual (McGraw-Hill Calculations)– December 10, 2004
6. Hydrodynamics of Offshore Structures by S.K. Chakrabarti, Springer-Verlag

REFERENCES:

1. Peter Smith ,The Fundamentals of Piping Design (Process Piping Design) (v.1) Hardcover – April 15, 2007
2. M. W. Kellogg, "Design of Piping Systems Paperback – July 6, 2011
3. Subrata K. Chakrabarti " Hand book of Offshore engineering " . Offhore structural analysis , Inc. volume II ELSEVIER (2005)

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering

Course Code	Ship Design Calculation Drawing & Drafting - V (SDCAD - V)	L	T	P	C
UCNA7PA		0	0	4	2

Year and Semester	IV Year (semester VII)		Contact hours per week	
Prerequisite course	NIL		(4Hrs)	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	1. To study the various tanks in the double bottom 2. To understand various systems, Arrangements, docking and launching calculation			
Course Outcome	After completion of the course, the students will be able to: 1. Identify & calculate the various tank used in Double bottom 2. Design the Bilge and Ballast system 3. Construct the various fuel oil, Lub oil and water systems used in ship 4. Develop the various fire and safety plans 5. Perform the launching plan and its calculations 6. Develop various ship system plans using software			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	2	3	3	2	-	-	-	-	-	3	2	-
CO2	3	1	-	2	3	3	2	-	-	-	-	-	3	2	1
CO3	3	-	2	2	3	3	3	-	-	-	-	-	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	-	-	3	3	3
CO5	1	2	3	3	2	3	2	-	-	-	-	-	3	-	3
CO6	1	2	3	3	2	2	3	-	-	-	-	-	3	1	2
AVERAGE	2.3	0.8	2.2	2	2.7	2.3	2.5	-	-	-	-	-	3	1.3	1.7
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)		

LIST OF ASSIGNMENTS

1. Calculation of Tank Capacity and its plan

2. Bilge and Ballast water system
3. Fuel Oil, Lub oil and Domestic water system
4. Fire Protection & Control plan.
5. Life Saving Appliance and Arrangements.
6. Dry docking and Launching Calculation.

Total : 60 Hours

TEXTBOOKS:

1. EYRES,D.J , Ship construction,1994
2. TAYLOR,D.A, Merchant ship construction ,2002
3. KEMP, Ship construction, 2002
4. PURSEY,H.J, Merchant ship construction ,2002

REFERENCES:

1. Robert Taggard, Ship Design & Construction
2. Eric c. Tupper, Introduction to Naval Architecture
3. Principle of Naval Architecture by Edward V.Lewis, Volume- III

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering

Course Code	Project Design & its Methodology	L	T	P	C
UCNA7PB		0	0	2	2

Year and Semester	IV Year (semester VII)		Contact hours per week	
Prerequisite course	NIL		(2Hrs)	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	This course aims to build students' knowledge of the processes and methodologies involved in designing an industrial/research project.			
Course Outcome	After completion of the course, the students will be able to: 1. Identify the importance of literature review in designing a project. 2. Define the project and come up with a project plan 3. Explain different concepts involved during designing a project 4. Explain the methods of technical report writing 5. Evaluate the data collected in from the literature 6. Create a methodology for carrying out various projects			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	1	-	-	-	-	1	2	2	2
CO2	2	2	2	2	2	2	1	-	-	-	-	1	2	2	2
CO3	2	2	2	2	2	2	1	-	-	-	-	1	2	2	2
CO4	3	3	3	1	1	2	1	-	-	-	-	1	2	3	3
CO5	2	2	2	1	1	2	1	-	-	-	-	1	2	2	2
CO6	2	2	2	1	1	2	1	-	-	-	-	1	2	3	3
AVERAGE	2.2	2.2	2.2	1.5	1.5	-	1.0	-				1.0	2.0	2.3	2.3

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

LIST OF EXPERIMENTS

1. Literature review and extracting information from the literature. Carryout minimum ten literature
2. Obtain the list of available resources and make a good project plan
3. Writing the summary of literature
4. With the obtained data through Literature, develop a research question (objective)
5. Learn the methods for data analysis and produce a proper project plan
6. Technical report writing and way of writing references and citation

Total : 45 Hours

REFERENCES:

1. Journal Publications (Scopus Indexed)
2. Conference Proceedings
3. Thesis/Project reports

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA7PC	Experimental Ship Hydrodynamics	L	T	P	C
		0	0	2	1

Year and Semester	IV Year (semester VII)		Contact hours per week (2Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. To study the experimental and techniques involved in model making and model testing methods
Course Outcome	After completion of the course, the students will be able to: 1. Demonstrate the model making techniques available for floating bodies – with practical exposure to model making 2. Perform basic experiments related to ship hydrodynamics 3. Compute the data from various model 4. Calculate Resistance with the available data and the procedure involved in a propeller design 5. Design the model of propeller and generate the data for various speeds 6. Understand the effect of seakeeping on the various models

POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	1	1	2	2	2	1	2	2	2
CO2	3	3	2	2	2	-	1	-	1	2	2	2	2	2	2
CO3	3	3	3	2	2	-	1	-	-	2	2	1	2	2	2
CO4	3	3	3	3	2	-	1	1	2	2	2	1	2	2	2
CO5	3	3	2	2	2	-	1	-	1	2	2	2	2	2	2
CO6	3	3	3	2	2	-	1	-	-	2	2	1	2	2	2
AVG	3.0	3.0	2.7	2.3	2.0	-	1.0	1.0	1.5	2.0	2.0	1.3	2.0	2.0	2.0
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

Model Making Techniques, Calibration of instruments, analysing the geometrically similar ship model, determination of CG of the Ship model, Inclining Experiment, estimating the Radius of Gyration of a Ship Model, Model preparation for resistance and seakeeping tests, IITC standards of model tests, Method of IITC 1978 resistance prediction method, Propeller design

Total : 30 Hours

REFERENCES:

1. Practical Ship Hydrodynamics. Volker Bertram, Butterworth-Heinemann, 2000
2. Dynamics of Marine Vehicles, R Bhattacharya, 1978

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Software Laboratory - IV	L	T	P	C
UCNA7PD		0	0	2	1

Year and Semester	IV Year (semester VII)		Contact hours per week (2Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. To learn the piping systems using the available piping software
Course Outcome	After completion of the course, the students will be able to: 1. Understand the usage of different tools to create model 2. Develop the model of piping system 3. Classify different material selection for various design 4. Generate 2 D plan 5. Prepare pipe routing and orientation plan 6. Create the design of pipelines based on requirement

POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	3	2	1	-	1	2	2
CO2	2	2	1	-	-	-	-	-	3	2	1	-	1	2	2
CO3	2	2	1	-	-	-	-	-	2	2	1	-	1	2	2
CO4	2	2	1	-	-	-	-	-	3	2	1	-	1	2	2
CO5	2	2	1	-	-	-	-	-	3	2	1	-	1	2	2
CO6	2	2	1	-	-	-	-	-	2	2	1	-	1	2	2
AVERAGE	2.0	2.0	1.0	-	-	-	-	-	2.7	2.0	1.0	-	1.0	2.0	2.0
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

General utilities, Pipe work modelling, material selection, Pipe routing and pipe orientation **Total : 30 Hours**
REFERENCES: 1. Software Manual
Designed by | " Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCMPCPY	Minor Project	L	T	P	C
		0	0	2	1

Year and Semester	IV Year (semester VII)		Contact hours per week (2Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	1. Implementing the self-understanding about technical and non-technical backgrounds. 2. Practising the skills of managing the time-bounded attributes of the projects. 3. Learning how things could be executed within time.			
Course Outcome	After completion of the course, the students will be able to: 1. Explain the pre-requisites for executing any basic project. 2. Show the skill of presentation 3. Develop a report by him/her 4. Apply the ideas penned down during the initial phase of the projects. 5. Summarize the outcomes in the systematically laid out pattern to comprehend effectively. 6. Judge the procedure based on the outcomes of the projects.			

POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	2	1	1	1	2	2	2	1	2	2	2
CO2	3	3	1	1	2	2	2	-	1	2	1	2	2	2	2
CO3	3	3	1	2	1	2	1	-	1	2	1	-	2	2	2
CO4	3	3	1	2	3	2	2	2	1	3	2	1	2	2	2
AVERAGE	3.0	3.0	1.0	1.5	2.0	1.8	1.5	1.5	1.3	2.3	1.5	1.3	2.0	2.0	2.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

GUIDELINES

▪ In minor project of student, he/she shall select one topic based on self-interest. There is no restriction on the field in which student is doing his/her minor project. Student is free to choose topic pertaining to field other than naval architecture/offshore engineering. ▪ Complete project shall be completed under the guidance of faculty over the period of one semester. ▪ Student shall be evaluated based on the internal reviews conducted by the department. **Total : 30 Hours**	
Designed by	" Department of Naval Architecture & Offshore Engineering"

SEMESTER : VIII

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA801	Shipyard Practice and Project Management	L	T	P	C
		4	0	0	4
Year and Semester	IV Year (semester VIII)		Contact hours per week (4Hrs)		
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. *To understand the various Shipyard Practices related to quality and production and to attain a good knowledge on project management and planning*				
Course Outcome	After completion of the course, the students will be able to: 1. Explain various aspects related to the Shipyard practices 2. Identify the principle involved in the production, management and planning 3. Illustrate and explain shipyard layout and productivity 4. Plan and schedule a ship construction/repair project 5. Role-play in Industrial Relations and Personnel Management 6. Role-play in General Project Planning, Project Scheduling				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	1	2	2	2	-	1	2	2	3	2	1
CO2	1	1	1	1	1	1	-	-	-	2	1	1	2	2	-
CO3	1	1	1	2	2	1	-	-	-	1	1	1	3	3	2
CO4	1	1	1	1	1	-	1	-	1	2	2	-	2	3	1
CO5	1	1	1	2	2	1	2	2	-	-	1	1	2	2	2
CO6	1	1	1	2	2	1	2	2	-	-	2	1	2	2	2
AVERAGE	1.0	1.0	1.0	1.6	1.5	1.2	1.8	2.0	1.0	1.5	1.5	1.2	2.3	2.3	1.6

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - INTRODUCTION TO SHIP YARD ACTIVITIES

Organizational Structure of Shipyards, Functional Departments of Shipyard- Production, Planning, Material, Financial, HR and Administration, Yard Utility, Various activities in Shipyard- Shipbuilding and Ship Repair

UNIT II - SHIP BUILDING PROCESS

General Process Planning, Principles of Design for Production, Production based structural assembly plan, Process Planning-Scheduling , Monitoring and Controlling, Material Planning and Contol, Quality Assurance Process in Shipyard- (Reciept Inspection, Test Certificates, Online quality Checks, QA format/check list preparation, Class Survey), Basin /Sea Trials and Delivery formalities

UNIT III – SHIPYARD LAYOUT AND PRODUCTIVITY

Shipyard Capacity Planning- Productivity in Shipyard- Measurement and Monitoring, Shipyard Capacity estimation, Role of process and procedure in Shipyard Capacity

evaluation, Shipyard Layout- Factors affecting, design of shipyard layout, Production facility layout, Some aspects of Shipyard Capacity augmentation, Developing Shipbuilding Strategy.

UNIT IV - PROJECT MANAGEMENT

General Project Planning, Project Scheduling, Application of models for process planning, scheduling and control - Gantt charts, CPM & PERT, Scheduling and Resource planning, Ship Repair Project Planning- Work Package (Direct and ancillary work), Work Scheduling, Monitoring. Planning tools- MS Project, Primavera

UNIT V – INDUSTRIAL AND HUMAN RELATIONS

Shipyard Management- Industrial Relation, Personnel Management, Human Relations and its importance, Contract Management, Managing Owners and Classification Society, Managing Vendors and subcontractors, CSR activities, EHS management, Labour laws and regulatory bodies

Total : 60 Hours

TEXTBOOKS:

1. Storch R. Lee, Hammon C.P. & Bunch H.M..; Ship Production, Cornell Maritime Press, Maryland, USA, 1988
2. Taggart; ship design and construction, SNAME chapter 15, 1980
3. Buffa, Modern production operations management, 6th edition, Wiley 1980

REFERENCES:

1. Eyres D.J.; Ship Construction William Heinemann Ltd, London, 1982
2. Dormidontov V. K. & et.al; Shipbuilding Technology, Mir publishers, Moscow

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Major project	L	T	P	C
UBNA8PC		0	0	22	11

Year and Semester	IV Year (semester VIII)	Contact hours per week
Prerequisite course	NIL	22 Hrs

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. Implementing the self-understanding about technical and non-technical backgrounds. 2. Practising the skills of managing the time-bounded attributes of the projects. 3. Learning how things could be executed within time.
Course Outcome	After completion of the course, the students will be able to: 1. Explain the pre-requisites for executing any basic project. 2. Show the skill of presentation 3. Develop a report by him/her 4. Apply the ideas penned down during the initial phase of the projects. 5. Summarize the outcomes in the systematically laid out pattern to comprehend effectively. 6. Judge the procedure based on the outcomes of the projects.

POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	2	1	1	1	2	2	2	1	2	2	2
CO2	3	3	1	1	2	2	2	-	1	2	1	2	2	2	2
CO3	3	3	1	2	1	2	1	-	1	2	1	-	2	2	2
CO4	3	3	1	2	3	2	2	2	1	3	2	1	2	2	2
AVERAGE	3.0	3.0	1.0	1.5	2.0	1.8	1.5	1.5	1.3	2.3	1.5	1.3	2.0	2.0	2.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

GUIDELINES

- The student is recommended to continue the work being initiated in the course namely, “Project design and its Methodology”
- Student shall be evaluated based on the internal reviews conducted by the department.
- Remaining work on the selected project shall be completed and achieving any innovative results is appreciated

Designed by	“ Department of Naval Architecture & Offshore Engineering”