SEMESTER I

PROGRAM	B.E (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)				
Course Code	Course Name	L	T	P	C
UALE12	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**

Use of technology to improve listening and speaking skills, Kinds of Listening –Techniques and Tips for Listening and Note taking - Articulation - Stress and Intonation-Conversation dialogue Writing -Professional Communication – Job Interview - Group Discussion.

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 (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UAMT13	Course Name Engineering Mathematics-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 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 **9 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 **9 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 **9 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 **9 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 Cosnx.

UNIT –V:- MULTIPLE INTEGRALS **9 hrs**

Double and triple integrals – Examples of double integration – exchanging the order of integration - 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 : 45 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 (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UAPH12	Course Name Engineering Physics		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**

Flow of current – Statement and explanation of Ohm's Law – Definition and explanation of Resistance and Specific Resistance – Effective resistance when resistors connected in series and parallel – Variation of resistance of a conductor with temperature – Thermistors - Kirchoff's current and voltage laws – Application of current and voltage laws on Wheatstone's bridge – Electromagnetics induction – Statement and explanation of Faraday's laws of Electromagnetic induction – Induced emf and current direction – Self and Mutual inductance – Principle, construction and working of AC & DC generators - Principle, construction and working of Transformer – Transformer losses and ways to reduce 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. 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 Pre

PROGRAM	BE – NA & OE				
Course Code UAEE11	Course Name: Basic Electrical and Electronics Engineering	L	T	P	C
		3	0	0	3
Year / 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 Objective	1. To provide the basic concepts of AC and DC circuits. 2. To learn the perception of magnetic circuits. 3. To understand the fundamental principles, construction, applications of DC & AC machines and measuring instruments.
Course Outcome	After the successful completion of the course, the students will be able to: 1. Outline KCL, KVL and related methods to solve DC circuits. 2. Infer the laws and principle of magnetic circuits. 3. Explain the principle of operation of three phase AC Circuits. 4. Demonstrate the working principle of electrical machines and measuring instruments. 5. Illustrate the safety measures and types of wiring. 6. Apply the knowledge of electric circuits for engineering application.

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	-	-	-	-	-	-	3	3	3	3
CO2	3	3	2	3	2	-	-	-	-	-	-	3	3	3	2
CO3	2	3	3	2	3	-	-	-	-	-	-	2	2	3	3
CO4	3	3	2	3	3	-	-	-	-	-	-	3	3	2	2
CO5	3	3	2	3	2	-	-	-	-	-	-	2	2	3	3
CO6	3	3	3	2	3	-	-	-	-	-	-	3	3	3	3
AVERAGE	2.83	2.83	2.50	2.67	2.67	-	-	-	-	-	-	2.67	2.33	2.50	2.5
CORRELATION LEVELS	1. SLIGHT (LOW)					2. MODERATE (MEDIUM)						3. SUBSTANTIAL (HIGH)			

UNIT I: FUNDAMENTALS OF DC CIRCUITS 9 hrs

Introduction to DC circuits, network elements, Ohm's Law and Kirchhoff‟s Laws - analysis of series and parallel circuits - Power and energy, Voltage - Current relations for resistor, inductor, capacitor, Mesh and Nodal analysis for simple circuits.

UNIT II : MAGNETIC CIRCUITS 9 hrs

Introduction to magnetic circuits- Faradays Laws, Statically and dynamically induced EMF; Concepts of self inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields.

UNIT III : AC CIRCUITS 9 hrs

Single Phase A.C. Circuits, Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor , concept of phasor representation, Analysis of simple R,L and C circuits- Introduction to three phase systems - types of connections, relationship between line and phase values.

UNIT IV: ELECTRICAL MACHINES & MEASURING INSTRUMENTS 9 hrs

Working principle, construction and applications of DC machines and AC machines (single phase transformers, single phase induction motors: split phase, capacitor start and capacitor start & run motors). Basic principles and classification of instruments - Moving coil and moving iron instruments.

UNIT V: ELECTRICAL SAFETY, WIRING & INTRODUCTION TO POWER SYSTEM 9 hrs

Safety measures in electrical system - types of wiring - wiring accessories, staircase, fluorescent lamps & corridor wiring - Basic principles of earthing - IS standards for Earthing- Types of earthing - Simple layout of generation, transmission and distribution of power.

Safety aspects with respect to marine systems, additional safety measures followed in ships

Total: 45 Hours

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 8 th edition, New Delhi, 2013.
2. Nagrath I.J. and D. P. Kothari , Basic Electrical Engineering, Tata McGraw Hill publishers, New Delhi, 2007.
3. Bhattacharya.S.K, "Basic Electrical and Electronics Engineering", First edition, Pearson Education, 2011

REFERENCES:

1.A.E. Fitzgerald, David.E.Higginbotham and Arvin Grabel,"Basic Electrcal Engineering", Tata Mc Graw Hill Education (India) Private Ltd.2009.
2. Metha.V.K, Rohit Metha, "Basic Electrical Engineering", Fifth edition, Chand. S & Co, 2012.
3. Mahmood Nahvi and Joseph A.Edminister,":Electric Circuits", Schaum Outline Series, Tata McGraw Hill,
5th edition, 2011.
4. Parker Smith, Problems in Electrical Engineering, CBS Publishers, 2003
5. Indian Standards "Code of Practice for Earthing", BIS, New delhi.2001Edition.

PROGRAM	B.E (NA & OE)				
Course Code UAEVC1	Course Name: Environmental Science		L	T	P	C
			2	0	0	2
Year and Semester	1 Year & I 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 Objective	The purpose of this course is to provide Knowledge about our ecosystem biodiversity, pollution prevention of pollution and save natural resources					
Course outcome	After the successful completion of the course, the students will be able to: 1. Summarize Natural Resources such as Forest, water, mineral, Energy, land and Natural. 2. Identify the interrelationship between living organism and environment. 3. Illustrate the importance of environment by assessing its impact on the human world. 4. Demonstrate different type of pollution and its hazards. 5. Explain the impact of pollution explosion, family welfare program and Role of Information Technology in Environment and human health. 6. Classify the integrated themes such as biodiversity natural resources, pollution control and waste management.					

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	2	2	-	-	2	-	-	-
CO2	-	-	-	-	-	2	3	3	1	-	-	2	-	-	-
CO3	-	-	-	-	-	2	3	3	1	-	-	2	-	-	-
CO4	-	-	-	-	-	3	3	2	2	-	-	3	-	-	-
CO5	-	-	-	-	-	3	3	3	2	-	-	3	-	-	-
CO6	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
AVERAGE	-	-	-	-	-	2.50	3.00	2.50	1.67	-	-	2.50	-	-	-
CORRELATION LEVELS	1. SLIGHT (LOW)					2. MODERATE (MEDIUM)						3. SUBSTANTIAL (HIGH)			

Unit 1: Natural Resources **6 Hrs**

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 2: Ecosystems **6 Hrs**

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 3 : Biodiversity and its conservation **6 Hrs**

Introduction – Definition : genetic, species and ecosystem diversity; Bio-geographical 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 4: Environment and Social Issues **6 Hrs**

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 5: Human Population and the Environment **6 Hrs**

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

References

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

PROGRAMME	BE- Naval architecture & Offshore Engineering				
Course Code UAMC11	Course Name : ENGINEERING MECHANICS	**L** 3	**T** 0	**P** 0	**C** 3
Year and Semester	I Year (I Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course Objective	*Develop the ability to understand, formulate and analyze any engineering problem in a simple logical manner and to solve basic problems in Engineering Mechanics*				
Course Outcome	Students will be able to				
	1	Determine the resultant force and moment for a given force system using laws of mechanics.			
	2	Apply the conditions of equilibrium on the rigid bodies with the forces in two dimensions.			
	3	Make use of friction laws and solve various problems of static and dynamic friction.			
	4	Determine the Centroid, moment of inertia of various sections.			
	5	Apply the laws of motion to solve the real life dynamic problems.			
	6	Solve the support reactions of the various beam with different loading conditions.			

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	-	2	-	2	3
CO2	3	3	3	3	-	-	-	-	-	-	-	2	3	-	2
CO3	3	2	2	3	-	-	-	-	-	-	-	3	2	3	-
CO4	3	2	2	3	1	-	-	-	-	-	-	2	3	2	2
CO5	3	3	2	2	-	-	-	-	-	-	-	3	-	3	2
CO6	3	2	3	2	1	-	-	-	-	-	-	3	-	2	3
AVERAGE	3	2.5	2.3	2.5	1	-	-	-	-	-	-	2.5	2.7	2.4	2.4
CORRELATION LEVELS				**1. SLIGHT (LOW)**				**2. MODERATE (MEDIUM)**				**3. SUBSTANTIAL (HIGH)**			

UNIT I - BASICS & STATICS OF PARTICLES — 9 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 — 9 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 — 9 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 — 9 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 y 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 – KINEMATICS OF RIGID BODIES **9 Hrs**

Kinematics of particles. Rectilinear motion. Curvilinear motion. Kinematics of particles: Newton's second law of motion. Motion of particles under central force. Kinetics of particles: energy and momentum methods. Work and energy. Impulse momentum. Central impact. Oblique impact. Conservation of momentum. Systems of particles. Impulse-momentum. Kinematics of rigid bodies. Plane motion of rigid bodies: forces and accelerations. Plane motion of rigid bodies: Energy and momentum methods. Angular momentum of rigid bodies in 3-D motion. Introduction to mechanical vibrations. Free vibrations. Forced vibrations

Total: 45 Hours

TEXT BOOKS

1. K.V. Natarajan, “Engineering Mechanics”.

2. R.S Khurmi, “A Textbook of Engineering Mechanics”.

REFERENCES

1 S.S. Bhavikatti, “Engineering Mechanics”

2 Palanichamy & Nagan, “Engineering Mechanics Statics & Dynamics”

3 S. Rajasekaran, G. SankaraSubramania, “Fundamentals of Engineering Mechanics”

4 Beer, F.P and Johnson Jr. E.R, “Vector Mechanics for Engineers”, Vol. (1) Statics andVol. (2) Dynamics, McGraw-Hill International Edition

PROGRAM	B.E (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)				
Course Code UAIT12	Course Name COMPUTER BASICS AND UTILITIES	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 provide the basic knowledge of computer, input and output devices. 2 To study the number system, program language generation and database concepts. 3 To learn the network strategies and network topologies 4 To understand the types of OS and working of internet
Course Outcomes	After successful completion of Course, the students will be able to 1. Outline the importance Computer types 2. Illustrate Numbering system & network strategies 3. Distinguish different tenses and identification of common errors 4. Infer the types of OS 5. Develop appropriate network tools to build network topologies 6. Apply the E learning strategies to develop a application

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	2	-	1	2	1	1
CO2	3	3	2	2	3	-	-	-	-	2	-	1	2	1	1
CO3	3	3	3	2	2	-	-	-	-	2	-	1	2	1	1
CO4	2	2	2	2	3	-	-	-	-	2	-	1	2	1	1
CO5	2	2	2	2	3	-	-	-	-	2	-	1	2	1	1
CO6	3	3	3	2	3	-	-	-	-	2	-	1	2	1	1
AVERAGE	2.5	2.5	2.33	2	2.67	-	-	-	-	2	-	1	2	1	1
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: Digital Computer **9 Hrs**

Block Diagram of Digital Computer and its functions-Classifications of Computer (Micro, Mini, Mainframes and Super computers)-Input and Output devices, Memory Devices.

UNIT II: Decimal Number System **9 Hrs**

Bit-Byte-Decimal Number System-Octal Number System-Hexadecimal Number System Conversions of binary and decimal -Package-Program Language Generations-Data-Record- File-Database-Master file-Transaction file-Work file-Backup file.

UNIT III: Characteristics of a LAN **9 Hrs**

LAN- -Network strategies-Point-to-point strategy-Multi-point strategy. Network Topologies: Mesh topology-Star topology-Ring topology-Bus topology- Cellular topology-Tree topology- Network Devices.

UNIT IV: Types of OS **9 Hrs**

Introduction –Types of OS-Functions of OS-Processor Management-Memory Management

–Device Management-Information Management-Compiler-Assembler-Interpreter-Loader and Linker.

UNIT V: Internet **9 Hrs**

Working of Internet(DNS,IP Address, Word Address, Dial Up connection, Dedicated Line Connection, ISDN, E-mail and Browsers)-Application of Computers – PMS- planning-Scheduling-documentation-The Psychology of Learning- E-learning- Benefits of E- learning.

Operating the computer using GUI based Operating System, Important features of web and web browsers, Use search engines and directories effectively, Use of FTTP and other services

Total: 45 Hours

TEXT BOOKS:

1. Foundations of Information Technology- Chanchal Mittal &PragatiPrakashan

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 (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UAMC1B	Course Name Engineering Graphics		L 0	T 0	P 2	C 1
Year and Semester	I Year & I 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	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

Isometric view - isometric projection – difference between isometric view and isometric projection - isometric scale - methods of drawing an isometric view- box method. Angles in Isometric view irregular curves in isometric drawing - circles in isometric method – four centre method for drawing an ellipse - arcs of circles in isometric – Draw the isometric view of the object from the given orthographic view - exercises

TOTAL: 30 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 (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UAIT1A	Course Name Computer Practical Laboratory		L 0	T 0	P 2	C 1
Year and Semester	I Year & I 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	1. To study the basics of computer , number system and computer languages					
Course Outcomes	After successful completion of Course, the students will be able to 1 Summarize basics of computer , number system and computer languages 2 Explain the concepts of formatting and alignment using word (MS-Office). 3 Illustrate the use of computer on ships. 4 Demonstrate the basic principles of learn avoiding redundant data. 5 Outline the basics of fill function for dates and formulas. 6 Apply the fundamentals presentation for a application					

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	2	-	1	2	1	1
CO2	3	3	2	2	3	-	-	-	-	2	-	1	2	1	1
CO3	3	3	3	2	2	-	-	-	-	2	-	1	2	1	1
CO4	2	2	2	2	3	-	-	-	-	2	-	1	2	1	1
CO5	2	2	2	2	3	-	-	-	-	2	-	1	2	1	1
CO6	3	3	3	2	3	-	-	-	-	2	-	1	2	1	1
AVERAGE	2.5	2.5	2.33	2	2.67	-	-	-	-	2	-	1	2	1	1
CORRELATION LEVELS				4. SLIGHT (LOW)				5. MODERATE (MEDIUM)				6. SUBSTANTIAL (HIGH)			

UNIT I: WORD PROCESSING 6 Hrs

Introduction – Shortcut keys - Identify the components of the word interface-Enter text in a document – Save a document – select text – Modify text – Find and Replace text - Character formatting - Align text using tabs – Apply styles – Apply Boarders and Shading – Bullets and Numbering – Tables- Insert a table – format a table – Convert text to table – Page Border and color- Watermark – Headers and footers – Creating Hyperlinks – Resize picture – Adjust the picture appearance – Wrap text around a picture – Pasting screen shots

- Create Text Boxes – Add word art and other special effects – Using Mail Merge creating envelopes and labels.

UNIT II: SPREADSHEET 6 Hrs

Introduction – Shortcut keys – Work with cells – Enter data in an workbook – Modifying an Excel worksheet – Searching data‘s in worksheet – Modify rows and columns – Modify fonts

–Insert and modify pictures and clip art - Apply borders and colors to cells – Align the content in a cell – Apply cell styles – Create and Modify tables – Format tables – Sort or Filter data – Using functions to

calculate data – Create a chart – Modify chart – Format charts – Freezing the row or column – Apply conditional formatting – Add data validation.

UNIT III: DATABASE APPLICATION 6 Hrs

Introduction – Identify the components of a Database – Constrain data entry using field properties – Create a database – Create a table using the design view – Modify table data, sort and filter records – Establish table relationships – Create query joins – Create a query – Add criteria to a query – Create a form – Modify the design of a form – view and edit data using an access form – Create a Report – Add a control to a report- Format the controls in a report.

UNIT IV: PRESENTATIONS 6 Hrs

Introduction – Create a Presentation – View a presentation – Save a presentation – Enter text- Edit text – Format text – Add slides to a presentation – Arrange slides – work with themes – working with slides – copying text and objects – Collapsing and expending slides

Applying Artistic effects – Using slide animation – Adding animation - Setting animations – Adding sound effect to an animation – Inserting Tables – Entering data in tables – Inserting Charts – Modifying charts – Customizing document themes

UNIT V: MS PROJECT 6 Hrs

Introduction to MS Project 2015- Defining and creating projects – Entering and scheduling tasks – Organizing Tasks – Working with Task Duration, Constraints and Deadlines – Introducing dependencies – Working with resources Project Management- Developing Project-Assigning resource to task- Tracking Progress – Managing Budget- Analysis workload.

TOTAL : 30 Hours

TEXTBOOKS:

1. Chatfield (Author), Johnson (Author),‖Microsoft Project 2013 Step by Step‖, 2013, Prentice Hall India Learning. 2013.
2. Gary B. Shelly (Author), Misty E. Vermaat (Author), ―Microsoft Office 2010: Advanced‖, Course Technology; First Edition, December 6, 2010.

PROGRAM	B.E (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code	Course Name		L	T	P	C
UALE1A	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 **12 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 **12 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 **12 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 **12 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 **12 Hrs**

Out of box thinking -Lateral Thinking- Intrinsic and Extrinsic Motivators- Factors influencing Attitude-Challenges and lessons from Attitude

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management - Work ethics – Good manners and etiquette

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

PROGRAM	B.E (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code	Course Name		L	T	P	C
UAWS1B	Workshop Practices-1		0	0	3	1
Year and Semester	I Year & I Semester		Contact Hours Per Week			
Prerequisite course	Nil		3 Hrs			
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 electric arc welding oxy – acetylene welding and fitting

Course Outcomes

After successful completion of Course, 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 and 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	-	-	-	1	2	-	-	-	-	-
CO2	2	-	1	-	2	-	-	-	1	2	-	-	-	-	-
CO3	2	-	2	-	1	-	-	-	2	2	-	-	-	-	-
CO4	2	-	1	-	2	-	-	-	2	2	-	-	-	-	-
CO5	2	-	2	-	1	-	-	-	2	2	-	2	-	-	-
CO6	2	-	3	-	2	-	-	-	1	2	-	2	-	-	-
AVERAGE	2	-	1.8	-	1.7	-	-	-	1.5	2	-	2	-	-	-
CORRELATION LEVELS	1. SLIGHT (LOW)				2. MODERATE (MEDIUM)							3. SUBSTANTIAL (HIGH)			

MACHINING: **20 Hrs**

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: **25 Hrs**

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, dyeing, assembling and dismantling of components - Practical exercises to develop and improve hands on skills.

TOTAL : 45 Hours

SEMESTER II

PROGRAM	B.E (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code	Course Name		L	T	P	C
UALE202	Technical English - II		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 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. 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

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 **4 Hrs**

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

UNIT II: VOCABULARY & ENGLISH GRAMMAR **8 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**

Power point Presentation – Role playing – better public speaking skills, Online and Offline Interview Skills, and Peer assisted learning.

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 Blackswan (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 (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UAMT203	Course Name Engineering Mathematics-II		L 3	T 1	P 0	C 4
Year and Semester	I Year & II 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 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 12 Hrs

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 – Laplace transforms of some common functions. First shifting theorem, Change of scale property. Laplace transforms of periodic functions, Laplace transforms of derivatives of derivatives and integrals, inverse Laplace transforms. Heaviside function, Dirac-delta function, Unit Step function, Convolution theorem and Laplace transforms method of solving differential equation of first and second order with constant coefficients.

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 (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UAMC204	Course Name Material Science		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	The purpose of this course is to provide comprehensive knowledge about various materials used in production of Engineering applications					
Course Outcomes	After successful completion of Course, the students will be able to 1. Infer knowledge on the materials and their alloys phases through phase diagram 2. Classify various ferrous and non ferrous materials 3. Apply various heat treatment methods applied on materials. 4. Use non metallic materials for application 5. Apply the concepts behavior of materials under force and their testing methods 6. Understand various types of materials used in ship building industry					

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	3	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	3	2	-	-
CO6	3	3	3	-	-	-	-	-	-	-	-	3	3	-	-
AVERAGE	3.00	2.50	2.50	-	-	-	-	-	-	-	-	3.00	2.50	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT 1:Materials Science and Engineering **9 Hrs**

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, Aluminum, Lead, Tin, Titanium. Materials for High and Low temperature service, classification of heat resistant materials

UNIT 2: Properties of materials **9 Hrs**

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 fibers 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 **9 Hrs**

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

UNIT 4: Material Testing **9 Hrs**

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, Radio- graphy, Magnetic particle inspection, Liquid Dye penetration test, Ultrasonic inspection test

UNIT 5:Environmental degradation of Materials **9 Hrs**

Corrosion rate, Current density, Exchange current density, Mixed potential theory, Polarization and Passivation. Characteristic features, causes and remedial measures of Uniform Corrosion, Pitting Corrosion, Crevice Corrosion, Galvanic Corrosion, Intergranular Corrosion, Erosion, Selective leaching, Stress corrosion cracking, Hydrogen Damage etc.

TOTAL: 45 Hours

TEXT BOOK:

3. Callister william D.Jr, ―Material Science and Engineering an Introduction‖, John Wiley & sonsinc.
4. O.P.Khanna, ―Material Science and Metallurgy‖, Dhanpat Rai PUAlications, 2014 edition.

REFERENCE BOOKS:

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.

PROGRAM	B.E (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UDCHC01	Course Name: Engineering Chemistry		L	T	P	C
			3	0	0	3
Year / 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 Objective

1. To classify the different types of polymeric materials and discuss their synthesis, properties and applications.
2. To summarize the various types of renewable and non-renewable energy sources and their working principles.
3. To discuss the various electrochemical cells and explain the mechanism of corrosion and control methods.
4. To explain the various nanomaterials and liquid crystals and discuss their applications.
5. To differentiate various types of water hardness, water treatment methods and boiler troubles.

Course Outcome

After the successful completion of the course, the students will be able to:

1. Summarize various synthetic methods and properties of polymers.
2. Discuss the principles of renewable and non-renewable energy resources.
3. Explain electrochemical cells, corrosion and its control methods.
4. Illustrate the types of nano materials and liquid crystals with their applications
5. Explain water treatment methods
6. Apply the knowledge of engineering chemistry in onboard ships

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	2	-	-	-	-	1	2	-	-
CO2	2	2	-	-	-	-	3	-	-	-	-	1	2	-	-
CO3	2	2	-	-	-	-	3	-	-	-	-	1	2	-	-
CO4	2	2	-	-	-	-	3	-	-	-	-	1	2	-	-
CO5	3	2	-	-	-	-	3	-	-	-	-	1	2	-	-
CO6	3	2	3	-	2	-	3	-	-	-	-	1	2	-	-
AVERAGE	2.33	2.00	3.00	-	2.00	-	2.83	-	-	-	-	1.00	2.00	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT-I: POLYMER CHEMISTRY **9 Hrs**

Polymers Introduction- Mechanism of polymerization - Physical and mechanical properties – Plastics as engineering materials: advantages and limitations – Thermoplastics and Thermosetting plastics – Preparation, properties and applications of polyethene, PVC, Bakelite Teflon and Polycarbonates Elastomers: Natural rubber- compounding and vulcanization – Synthetic rubbers: Buna S, Buna N, Thiokol and polyurethanes – Applications of elastomers. Composite materials& Fiber reinforced plastics – Biodegradable polymers – Conducting polymers.

UNIT-II: ENERGY SCIENCE **9 Hrs**

Fuels – Introduction – Classification – Calorific value - HCV and LCV –Coal — Proximate and ultimate analysis – Significance of the analyses – Liquid fuels – Petroleum- Refining – Cracking – Synthetic petrol –Petrol knocking – Diesel knocking - Octane and Cetane ratings – Anti-knock agents Bio-diesel – Gaseous fuels – Natural gas, LPG and CNG – Combustion – Calculation of air for the combustion of a fuel – Flue gas analysis – Orsat apparatus. Non Conventional Energy Sources –Wind, Solar, Geothermal, Hydro and nuclear energy

UNIT-III: ELECTROCHEMICAL CELLS AND CORROSION **9 Hrs**

Electro chemical cell and series - uses of this series- Concentration Cells – Batteries: Dry Cell - Ni-Cd cells - Li cells –Fuel cells- Corrosion– Theories of Corrosion (chemical & electrochemical) – Formation of galvanic cells by different metals, by concentration cells, by differential aeration and waterline corrosion – Passivity of metals – Pitting corrosion - Galvanic series – Factors which influence the rate of corrosion - Protection from corrosion – Design and material selection – Cathodic protection - Protective coatings: – Surface preparation – Metallic (cathodic and anodic) coatings - Methods of application on metals (Galvanizing, Tinning, Electroplating, Electroless plating).

UNIT-IV: CHEMISTRY OF ADVANCED MATERIALS **9 Hrs**

Nano materials: - Introduction – Sol-gel method & chemical reduction method of preparation – Carbon nano tubes and fullerenes: Types, preparation, properties and applications- Liquid crystals:- Introduction – Types – Applications.

UNIT-V: ORGANIC COMPOUNDS **9 Hrs**

Hydrocarbon- Petroleum & its products, extraction of aromatic compounds from petroleum. Aromatic compounds - Benzene; polycyclic hydrocarbons- Naphthalene, anthracene, naphthacene. Polymeric products from hydrocarbon: Fibre and Reinforced plastics. Steel Production - Open hearth process, Bessemer converter process., Chemical addition to steels production of non-ferrous alloys, brass, bronze, aluminum alloys. Special reference to ship building (ship propellers etc). Heat Treatment of Carbon Steel. Material Science & Technology - Metallurgy of Steel and Cast Iron, Properties and application of material used in machinery on board ship Basic Metallurgy, Metals and Processes, Properties and Uses, Non-Metallic Materials. Characteristics and limitations of process used for fabrication and repair.

Total: 45 Hours

TEXT BOOKS :

1. S. S. Dara and S. S. Umare, “A Textbook of Engg Chem”, S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, “Engg Chem” Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, “Engg Chem”, Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES BOOKS:

1. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, “Engineering Chemistry”, Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, 2015.

PROGRAMME	BE- Naval architecture & Offshore Engineering				
Course Code	Course Name :	L	T	P	C
UAMC205	APPLIED THERMODYNAMICS	3	0	0	3

Year and Semester	I Year (II Semester)	Contact hours per week	
Prerequisite course	NIL	(3Hrs)	
Course Objectives	*This course provides basic knowledge about thermodynamics and relation and their application to various processes*		
Course Outcome	Students will be able to		
	1	Understand thermodynamics laws and their application	
	2	Attain knowledge on concept of entropy and availability	
	3	Know about the properties of steam and their uses of steam table and mouier chart	
	4	Correlate thermodynamics relation	
	5	Utilize psychometric chart	
	6	Understand the application of thermodynamics in industry.	

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	-	2	-	2	3
CO2	3	3	3	3	-	-	-	-	-	-	-	2	3	-	2
CO3	3	2	2	3	-	-	-	-	-	-	-	3	2	3	-
CO4	3	2	2	3	1	-	-	-	-	-	-	2	3	2	2
CO5	3	3	2	2	-	-	-	-	-	-	-	3	-	3	2
CO6	3	2	3	2	1	-	-	-	-	-	-	3	-	2	3
AVERAGE	3	2.5	2.3	2.5	1	-	-	-	-	-	-	2.5	2.7	2.4	2.4

CORRELATION LEVELS	4. SLIGHT (LOW)	5. MODERATE (MEDIUM)	6. 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 irreversible processes. - 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- Reduced properties-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 MIXTURES AND PSYCHROMETRY **9 Hrs**

Mixtures of ideal gases, Psychrometry and its applications. Speci-c and relative humidity. Dew point.Saturation and wet bulb temperature. Psychrometric chart. Conditioning of air and applications (air-evaporative cooling, cooling towers, humidi-cation,etc. Reacting systems. 1-step reactions. Stoichiometry, equivalenc ratio. Enthalpy of formation. Conservation of mass. 1 st law analysis.Heat of reaction and properties. Adiabatic ame temperature. Work of reaction.Enthalpy of formation. 2 nd law analysis. Application to combustion, fuel cells.Introduction to multi-step reactions and minor species

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

REFERENCES

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 (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UALE2PA	Course Name Soft skills - II		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 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.					
Course Outcomes	After successful completion of Course, the students will be able to 1. Make use of 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. Make use of listening and speaking skills for effective presentation 5. Develop good attitude , behavior and communication skills 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	-	-	-	-	-	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)			

UNIT 1: GRAMMAR AND FOUNDATON **12 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 **12 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 **12 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 **12 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 **12 Hrs**

Prepare for the interview, Know common interview questions and questions, Describe what employers want, Know proper attitude and effort employers are looking for, Describe body language and its impact on the interview

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

PROGRAM	BE-NA & OE				
Course Code: UAMC1PA	Course Name : Engineering Mechanics Laboratory	L	T	P	C
		0	0	2	1

Year and Semester	I Year (II Semester)	Contact hours per week (2Hrs)
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 learn about different types of testing methods of metals. 2. To evaluate material testing on elasticity 3. To evaluate material testing on hardness 4. To evaluate material testing on shear strength 5. To Determine modulus of rigidity of open spring and closed coil springs.
Course Outcome	After successful completion of the course, the students should be able to 1. Evaluate the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test. 2. Develop the procedure to perform Hardness test and finding hardness number with various specimens 3. Experiment with Deflection test on Mild Steel, Aluminium to find the young's modulus. 4. Estimate the modulus of rigidity of Mild steel using torsion test 5. Examine the stiffness of the open coil and closed coil spring and grade them. 6. Experiment with given specimen to find the compression strength and fatigue strength and impact strength of materials.

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	2.7	2.7			3			3	3		3	2.5		

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

LIST OF EXPERIMENTS

1. Test on Ductile Materials: Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.
2. Hardness Test: Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.
3. Beam Deflection Test: Deflection test on Mild steel and Aluminium– relation between load and deflection.
4. Impact test: Finding the resistance of materials to impact loads by Izod test and Charpy test.
5. Tests on springs of circular section: Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring)
6. Shear test: Single or double shear test on M.S. bar to finding the resistance of material to shear load.
7. Compression Test: Finding Compression strength of a concrete block.
8. Fatigue Test: Finding Number of cycles to failure of a given specimen.
9. Cupping Test: Testing the deformability of a sheet and Finding the Cupping number.

TOTAL : 30 HOURS

PROGRAM	B.E (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UAPH2PB	Physics Laboratory		L	T	P	C
			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 Objectives

The aim of this lab is to fortify the students with an adequate work experience in the measurement of different quantities and also then expertise in handling the instruments involved.

Course Outcomes

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

1. Make use of Spectrometer for Wavelength determination
2. Infer Newton‘s Rings to obtain radius of a curvature of a convex lens
3. Apply Field along the axis of a coil to get H determination
4. Classify Non-uniform bending
5. Infer Torsional pendulum
6. Understand Poiseulli‘s flow

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				4. SLIGHT (LOW)				5. MODERATE (MEDIUM)				6. SUBSTANTIAL (HIGH)			

1. To determine the moment of inertia of a flywheel about its own axis of rotation.
2. To determine the frequency of A.C. mains using sonometer and an electromagnet.
3. Spectrometer – Grating – Wavelength determination
4. Newton‘s Rings – radius of a curvature of a convex lens
5. Field along the axis of a coil – H determination
6. Air Wedge – Diameter of a wire
7. Calibration of a low range voltmeter
8. Spectrometer – Dispersive power
9. Non-uniform bending – Pin and microscope
10. Torsional pendulum – determination of n
11. Viscosity – Poiseulli‘s flow
12. Uniform bending – Young‘s modulus of the material of a given bar

TOTAL: 30 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

PROGRAM	BE- Naval architecture & Offshore Engineering				
Course Code	Course Name :	L	T	P	C
UAEE1PB	ELECTRICAL AND ELECTRONICS LABORATORY	0	0	2	1

Year and Semester	I Year (II Semester)	Contact hours per week (2Hrs)	
Prerequisite course	NIL		
Course Objective	*The aim of this lab is to fortify the students with an adequate work experience in the measurement of different quantities and also then expertise in handling the instruments involved.*		
Course Outcome	At the end of the course, the student should be able to:		
	1	Acquire knowledge and skills about electric instruments, such as ammeter, voltmeter multimeter, oscilloscope.	
	2	Identify and learn properties about main electrical components, such as resistors, capacitors, inductors, ,	
	3	Acquire knowledge and skills about voltage source, AC power sources and service equipment	
	4	Acquire knowledge and skills about transformers	
	5	Perform the working of diode,FET,etc.	
	6	Perform the working of various Electronics devices.	

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	2	-	1	2	1	1
CO2	3	3	2	2	3	-	-	-	-	2	-	1	2	1	1
CO3	3	3	3	2	2	-	-	-	-	2	-	1	2	1	1
CO4	2	2	2	2	3	-	-	-	-	2	-	1	2	1	1
CO5	2	2	2	2	3	-	-	-	-	2	-	1	2	1	1
CO6	3	3	3	2	3	-	-	-	-	2	-	1	2	1	1
AVERAGE	2.5	2.5	2.33	2	2.67	-	-	-	-	2	-	1	2	1	1

CORRELATION LEVELS	7. SLIGHT (LOW)	8. MODERATE (MEDIUM)	9. SUBSTANTIAL (HIGH)

LIST OF EXPERIMENTS

1. Measurement of 'Low and High' resistances by Voltmeter and Ammeter method.
2. To obtain the current and voltage distribution in A.C. 'R-L-C' series circuits and draw the vector diagrams.
3. To obtain the current and voltage distribution in AC 'R.L.C' parallel circuits and draw the vector diagrams.
4. To measure the power and power factor of a single-phase load by voltmeter method & ammeter method.
5. To 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 (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UAWS2PB	Course Name Workshop Practices Laboratory-II		L 0	T 0	P 3	C 2
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 provide exposure to the students with hands on experience on electric arc welding oxy – acetylene welding and fitting					
Course Outcomes	After successful completion of Course, 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 and 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	-	-	-	1	2	-	-	-	-	-
CO2	2	-	1	-	2	-	-	-	1	2	-	-	-	-	-
CO3	2	-	2	-	1	-	-	-	2	2	-	-	-	-	-
CO4	2	-	1	-	2	-	-	-	2	2	-	-	-	-	-
CO5	2	-	2	-	1	-	-	-	2	2	-	2	-	-	-
CO6	2	-	3	-	2	-	-	-	1	2	-	2	-	-	-
AVERAGE	2	-	1.8	-	1.7	-	-	-	1.5	2	-	2	-	-	-
CORRELATION LEVELS				4. SLIGHT (LOW)				5. MODERATE (MEDIUM)				6. SUBSTANTIAL (HIGH)			

ELECRIC ARC WELDING **20 Hrs**

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 **25 Hrs**

Types of oxy-acetylene flames and uses. - Acetylene gas properties and generating methods. - Oxygen gas and its properties – 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 - Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing - Silver brazing on copper tube to tube - Marking and straight line cutting of MS plate. 10 mm thick by gas. - Beveling of MS plates 10 mm thick by gas cutting

.

TOTAL : 45 Hours

SEMESTER III

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UAMT301	Engineering Mathematics III	L	T	P	C
		3	1	0	4

Year and Semester	II Year (semester III)		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. To acquaint the student with Fourier transform techniques used in wide variety of situations.
2. 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 principles of partial differential equations
2. Estimate the Fourier transform coefficients
3. Summarize wide applications of PDEs
4. Analyze the mathematical principles on transforms
5. Apply the principles of transforms in engineering applications
6. Formulate and mathematically solve some of the physical problems in Engineering.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	1	1	-	1	-	-	1	1	2	2
CO2	2	2	2	2	1	1	1	-	1	-	-	1	1	2	2
CO3	2	2	2	2	1	1	1	-	1	-	-	1	1	2	2
CO4	2	2	2	2	1	1	1	-	1	-	-	1	1	2	2
CO5	3	3	3	1	1	1	1	-	1	-	1	1	1	2	2
CO6	3	3	3	1	1	1	1	-	1	-	1	1	1	2	2
AVERAGE	2.33	2.33	2.33	1.67	1	1	1	0	1	0	1	1	1	2	2

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

UNIT I - PARTIAL DIFFERENTIAL EQUATIONS **12 Hrs**

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

$$f(p,q)=0, f(z,p,q)=0, f(x,p)=f(y,q) \text{ and } z=xp+yq+f(p,q)$$

UNIT II - FOURIER SERIES **12 Hrs**

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 **12 Hrs**

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 **12 Hrs**

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

UNIT V - Z - TRANSFORMS **12 Hrs**

Properties of the z-transform and how it is related to the discrete-time Fourier, sampling of continuous-time signals and the conditions needed for perfect reconstruction, analyse the associated quantization error, finite impulse response (FIR) and infinite impulse response (IIR) discrete-time filters.

Total: 60 Hours

TEXTBOOKS:

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"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA302	Fundamentals of Naval Architecture	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester III)	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. To provide the basic knowledge on type of ships and its parts. 2. To know about the Shipyard process and its production. 3. To know about the lines plan of a ship and its hydrostatic calculation.
Course Outcome	After completion of the course, the students will be able to: 1. Recognize different types of ships 2. Explain various rules and principles in ship building 3. Understand the ship building process and materials requirement in shipyard. 4. Identify various shipyard processes 5. Develop the lines plan of a ship 6. Learn the procedure for Hydrostatic calculations

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	1	1	-	1	-	-	1	2	3	3
CO2	2	2	2	2	1	1	1	-	1	-	-	1	2	2	3
CO3	2	2	2	2	1	1	1	-	1	-	-	1	1	2	3
CO4	2	2	2	1	1	1	1	-	1	-	-	1	1	2	2
CO5	3	3	3	1	1	1	1	-	1	1	1	1	1	3	2
CO6	3	3	3	1	1	1	1	-	1	1	1	1	1	2	2
AVERAGE	2.33	2.33	2.5	1.5	1	1	1	0	1	1	1	1	1.33	2.33	2.5

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

UNIT 1: Introduction to Naval Architecture **9 Hrs**

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

UNIT II: Types of Ships and General arrangement **9 Hrs**

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

UNIT III: Shipyard Process **9 Hrs**

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

UNIT IV: Lines plan and Different types of rules **9 Hrs**

Lines plan – fairing process- table of offsets. Interaction rules – trapezoidal rule; Simpson‘s rule (1-4-1, 1-3-3-1 and 5, 8,-1 rule) 6 ordinate rule; Tchebycheff‘s rule.

UNIT V: Hydrostatic Calculations **9 Hrs** Displacement, TPC, MCTC1, BM, etc.volumes and moments, Bonjean curves, application of Hydrostatic calculations and its curves. **Total: 45 Hours**	
TEXTBOOKS: 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"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA303	Theory of Ships	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester III)		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. To understand the basic concepts of Ship stability 2. To learn Transverse and Longitudinal Stability 3. Stability of ship in damage condition			
Course Outcome	After completion of the course, the students will be able to: 1. Explain the stability of ship in various loading conditions 2. Illustrate the basics of ship theory 3. Describe the transverse stability parameters for the ship 4. Define the longitudinal stability parameters of the ship 5. Recognize the stability of vessel in damage condition by added weight and lost buoyancy method 6. Design the ship parameters as per various rules and regulations			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	2	-	1	-	-	1	2	3	3
CO2	3	2	2	2	1	1	2	-	1	-	-	1	2	2	3
CO3	2	3	2	2	1	2	1	-	1	-	-	1	1	2	3
CO4	2	2	2	1	1	1	1	-	1	-	-	1	2	2	2
CO5	3	3	3	1	1	1	2	-	1	1	1	1	1	3	2
CO6	3	3	3	1	1	2	1	3	1	1	1	1	1	2	2
AVERAGE	2.67	2.67	2.5	1.5	1	1.33	1.5	3	1	1	1	1	1.5	2.33	2.5

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

UNIT 1: Introduction **6 Hrs**

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

UNIT II: Basics of ship theory **9 Hrs**

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

UNIT III: Transverse Stability **12 Hrs**

Transverse stability:- Form and weight stability - stability functions, Initial stability – GM, GZ at small angles of inclinations, wall sided ships; Stability due to addition, removal and transference (horizontal, lateral and vertical) of weight, suspended weight and free surface of liquids; Stability while docking and grounding; Inclining experiment. Large angle stability - Diagram of statically stability (GZ - curve), Characteristics of GZ - curve, static equilibrium criteria; Methods for calculating the GZ - curve (Krylov, Prohaska, etc.); Cross

curves of stability; Dynamical stability - diagram of dynamical stability, dynamical stability criteria.

UNIT IV: Longitudinal Stability **9 Hrs**

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

UNIT V: Damage Stability **9 Hrs**

Damage stability - deterministic and probabilistic approach. Stability in Waves. IMO recommendations for Intact and damage stability rules. Compartmentation and floodable length calculation.

Total: 45 Hours

TEXTBOOKS:

4. Edward V Lewis, Principle of Naval Architecture, Vol-1, III EDITION, The Society of Naval Architects and Marine Engineers, 1988
5. 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"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UAMC309	Strength of Materials	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester III)		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. To gain knowledge on simple stress and strain, 2. To design a block based on stress and strain, 3. To design a cylinder, column and beam			
Course Outcome	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. Explain principal stress and strain and its application in 2D & 3D. 3. Describe shear force, bending moment 4. Illustrate shear force diagram & bending moment diagram for various types of beam and loads. 5. Derive bending equation, shear stress equation and able to identify bending stress & shear stress in a beam. 6. Explain a thin cylinder, columns and able to evaluate the thickness of cylinder & bucking load for columns			

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	-	1	-	-	1	2	2	2
CO2	2	2	2	2	2	1	2	-	1	-	-	1	2	2	3
CO3	2	3	2	2	2	2	1	-	1	-	-	1	1	2	2
CO4	2	2	2	1	1	1	1	-	1	-	-	1	2	2	2
CO5	2	3	3	1	1	1	2	-	1	1	1	1	1	3	2
CO6	2	3	3	1	1	2	1	-	1	1	1	1	1	2	2
AVERAGE	2.0	2.5	2.5	1.5	1.5	1.33	1.5	0	1.0	1.0	1.0	1.0	1.5	2.17	2.17
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1: Stress and Strain **9 Hrs**

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 **9 Hrs**

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 **9 Hrs**

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 contraflexure, Maximum bending stress

UNIT 4: Bending and shear stresses in beams **9 Hrs**

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 **9 Hrs**

Introduction, Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, Power transmitted by solid and hollow circular shafts, Calculation of Shaft diameter. Bending due to torsion.

Total: 45 Hours

TEXTBOOKS:

1. Strength of Materials by Dr.R.K.Bansal
2. Strength of Materials by Dr. S. Ramamrutham

REFERENCES:

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

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering			
Course Code UAMC308	Fluid Mechanics	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester III)	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. To understand the properties and characteristics of fluids 2. To learn the flow of fluids through pipes 3. To analyze the performance of pumps and turbines.
Course Outcome	After completion of the course, the students will be able to: 1. Identify various properties of fluids 2. Describe different governing equations for fluid flow. 3. Explain types of flow and boundary layer concepts 4. Analyze the flow through pipes. 5. Identify various types of pumps along with their applications and analyze the flow through pumps. 6. Evaluate the performance and efficiencies of different types of turbines

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	-	1	-	-	1	2	2	2
CO2	2	2	2	2	2	1	2	-	1	-	-	1	2	2	3
CO3	2	3	2	2	2	2	1	-	1	-	-	1	1	2	1
CO4	2	2	2	1	1	1	1	-	1	-	-	1	2	2	1
CO5	2	3	3	1	1	1	2	-	1	1	-	1	1	1	2
CO6	2	3	3	1	1	2	1	-	1	1	-	1	1	1	2
AVERAGE	2.0	2.5	2.33	1.5	1.5	1.3	1.5	0	1.0	1.0	0	1.0	1.5	1.67	1.83

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

UNIT 1: FLUID PROPERTIES AND FLOW CHARACTERISTICS **9 Hrs**

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 **9 Hrs**

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 **9 Hrs**

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 **9 Hrs**

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 **9 Hrs**

Classification of turbines – heads and efficiencies – velocity triangles components of velocity triangle, Calculation of radial and axial components. Example for Axial, radial and mixed flow turbines. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

Total: 45 Hours

TEXTBOOKS:

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 Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UAEE302	Marine Electrical Technology	L	T	P	C
		2	0	0	2

Year and Semester	II Year (semester III)		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	To impart knowledge on 1. AC motors and AC motor starters 2. AC machines 3. Marine switch boards, Neutral system, Emergency supply and Insulation resistance 4. DC machines & Lighting systems in ships 5. Electrical installations & safety and instrumentation
Course Outcome	After completion of the course, the students will be able to: 1. Define AC motor starters 2. Explain the principle of AC generators 3. Operate AC & DC machines and obtain its characteristics. 4. Recognize ship switch board layout and its characteristics 5. Categorize lighting systems and measuring devices. 6. Describe electrical installations, safety and instrumentation

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	-	2	-	-	2	2	2	2
CO2	2	2	2	2	2	1	2	-	2	-	-	1	2	2	3
CO3	2	3	2	2	2	2	1	-	2	-	-	1	1	2	1
CO4	2	2	2	1	-	1	1	-	1	-	-	-	2	2	1
CO5	2	3	3	-	1	1	2	-	1	1	-	1	1	1	2
CO6	2	3	3	1	1	2	1	-	1	1	-	1	1	1	2
AVERAGE	2.0	2.5	2.3	1.6	1.6	1.3	1.5	0	1.5	1.0	0	1.2	1.5	1.67	1.83

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

UNIT 1: AC MOTORS & AC MOTOR STARTERS **6 Hrs**

Understand the Principle of Operation of a Direct On-Line Starter (Dol) Starter, Star Delta Starter, Autotransformer Starter, Understand the Need and Means for Motor Protection. 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 **6 Hrs**

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 **6 Hrs**

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 **6 Hrs**

Understand the Construction and Principle of Operation of a Dc Generator and Dc Motor. Understand Different Types of Lightings Installed Onboard Ships. Understand Principle Of 3 Phase Alternating Voltage Generation.

UNIT V: ELECTRICAL INSTALLATIONS & SAFETY AND INSTRUMENTATION **6 Hrs**

Electric shock and burns from contact with **live** parts. injury from exposure to arcing, fire from faulty **electrical** equipment or installations and Safe Electrical Practice. Fuse Protection, General Maintenance and measurement of basic variables.

Total: 30 Hours

TEXTBOOKS:

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 Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UAME302	Marine Engineering	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester III)		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. To study construction and operation of various blower head on board the vessel. 2. To learn about steering gear and operation and transmission of engine power to shaft. 3. To gain knowledge about dry docking and important routine jobs carried out before dry dock
Course Outcome	After completion of the course, the students will be able to: 1. Explain marine diesel engines and the general engine principles 2. Describe the engine dynamics 3. Identify the types of boilers and its operations 4. Extract the design and type of blower for the ship as per the demand. 5. Illustrate the routine maintenance of steering gear and shafting components. 6. Sketch the important maintenance works of the ship in the dry dock

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	-	2	-	-	2	2	2	2
CO2	2	2	2	2	2	1	2	-	2	-	-	1	2	2	3
CO3	2	3	2	2	2	2	1	-	2	-	-	1	1	2	1
CO4	2	2	2	1	-	1	1	-	1	-	-	-	2	2	1
CO5	2	3	3	-	1	1	2	-	1	1	-	1	1	1	2
CO6	2	3	3	1	1	2	1	-	1	1	-	1	1	1	2
AVERAGE	2.17	2.67	2.5	1.8	1.8	1.67	1.67	0	1.5	1.0	0	1.2	1.5	1.67	1.83

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

UNIT I: SHIPS AND MACHINERY **9 Hrs**

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 lub 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 DYNAMICS **9 Hrs**

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 **9 Hrs**

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

UNIT IV: MARINE STEAM TURBINES **9 Hrs**

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: MARINE GAS TURBINES **9 Hrs**

Principles, construction, function, components, control and monitoring systems, and operation of a gas turbine propulsion plant and associated auxiliary support systems, Nuclear propulsion, Air Conditioning and Refrigeration- Psychrometric process

Total: 45 Hours

TEXTBOOKS:

1. Harrington; Marine Engineering, SNAME Publications.
2. Pounder, C.C; Marine Diesel Engines, Newnen-Butterworths, London.

REFERENCES:

1. Reed's Marine Engineering for Naval Architect.
2. Taylor, D.A.; Introduction to Marine Engineering.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA3PA	Ship Design Calculation Drawing & Drafting – I SDCADD- I	L	T	P	C
		0	0	2	1

Year and Semester	II Year (semester III)	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. Gaining 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 bilge keel, camber 4. Define and draw stem and stern of ship 5. Sketch stem and stern profile 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	2	2	2	1	1	2	2	1	1	2	2	1	2	3	2
CO2	2	2	2	1	1	2	2	1	1	2	2	1	1	3	3
CO3	2	2	2	1	1	2	2	1	2	2	2	1	2	2	2
CO4	2	2	2	1	1	2	2	1	2	2	2	1	2	2	2
CO5	2	2	2	1	1	2	2	1	2	2	2	1	1	2	2
CO6	2	2	1	1	1	2	2	1	2	2	2	1	1	2	3
AVERAGE	2.0	2.0	1.83	1.0	1.0	2.0	2.0	1.0	1.67	2.0	2.0	1.0	1.5	2.33	2.33

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

UNIT 1: OFFSET TABLE

BSRA series, deriving offset table from BSRA series

UNIT II: LINES PLAN

Drawing lines plan manually using the derived offset table, drawing bilge keel, camber, stem and stern

UNIT III: AUTO CAD DRAWING

Basic CAD commands, drawing of lines plan in Auto CAD software, application of AutoCAD in ship design.

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 UAMCCPC	Fluid Mechanics Laboratory	L	T	P	C
		0	0	2	1

Year and Semester	II Year (semester III)	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 understand the properties and characteristics of fluids 2. To analyze the performance of pumps and turbines
Course Outcome	After completion of the course, the students will be able to: 1. Identify various properties of fluids and governing equations for fluid flow. 2. Describe the types of flow and boundary layer concepts 3. Analyze the flow through pipes. 4. Illustrate the met centric height and condition of equilibrium 5. Identify various types of pumps along with their applications and analyze the flow through pumps. 6. Relate the performance and efficiencies of different types of turbines

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	2	1	1	2	2	1	2	2	2
CO2	3	2	2	2	1	2	2	1	1	2	2	1	1	3	3
CO3	2	2	2	1	2	2	2	1	2	2	2	1	2	2	2
CO4	2	2	2	1	2	2	2	1	2	2	2	1	2	2	2
CO5	2	2	2	1	1	2	2	1	2	2	2	1	1	2	2
CO6	2	2	1	1	1	2	2	1	2	2	2	1	1	2	3
AVERAGE	2.33	2.17	1.83	1.33	1.33	2.0	2.0	1.0	1.67	2.0	2.0	1.0	1.5	2.17	2.33

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

LIST OF EXPERIMENTS

1. To find the co-efficient of discharge in venturi-meter
2. To verify the Bernoulli‘s Theorem for pipe flow
3. To find the co-efficient of discharge in Orifice
4. To find the co-efficient of discharge in Pitot Tube
5. To find the wetted surface of block
6. To find the fine coefficients of arbitrary solid shape
7. To find the co-efficient of discharge in Pipe Friction apparatus
8. To determine the discharge in Triangular Notch
9. To determine the Metacentric Height (GM) of the ship.
10. To determine the discharge of Jet Pump
11. To determine the discharge of Centrifugal Single stage Pump
12. To determine the discharge of Reciprocating Pump

Total: 30 Hours

Designed by	“ Department of Naval Architecture & Offshore Engineering”

PROGRAM	B.E (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UALECPD	Course Name Soft skills - III		L 2	T 0	P 2	C 2
Year and Semester	II Year & III 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

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

Course Outcomes

After successful completion of 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

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				SLIGHT (LOW)				MODERATE (MEDIUM)				SUBSTANTIAL (HIGH)			

UNIT1:GRAMMAR AND FOUNDATON **6 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 **6 Hrs**

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: INTERACTIVE ENGLISH **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: 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

UNITV: INTERVIEW SKILLS AND PERSONALITY DEVELOPMENT **6 Hrs**

Speaking skills, Negotiation skills, Body language improvisation, listening skills, exit interviews
Personality development – Self motivation, Self actualization, Self realization, Stress management

TOTAL: 30 HOURS

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

SEMESTER IV

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UAMTC04	Probability and Statistics	L	T	P	C
		3	1	0	4

Year and Semester	II Year (semester IV)		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. Acquire skills in handling situations involving more than one random variable and functions of random variables.
2. Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
3. Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

Course Outcome

After completion of the course, the students will be able to:

1. Define statistical methods involving one and several random variables.
2. Identify decision making analysis
3. Extract the nature of sampling distributions to management problems.
4. Solve scientific problems using statistical methods
5. Use statistical methods in the realm of scientific experiments and the testing of hypothesis
6. Design and analyze the mathematical techniques involved in experiments

POS/COS	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2	PSO 3
CO1	2	2	2	2	1	1	1	-	1	-	-	1	1	2	2
CO2	2	2	2	2	1	1	1	-	1	-	-	1	1	2	2
CO3	2	2	2	2	1	1	1	-	1	-	-	1	1	2	2
CO4	2	2	2	2	1	1	1	-	1	-	-	1	1	2	2
CO5	3	3	3	1	1	1	1	-	1	-	1	1	1	2	2
CO6	3	3	3	1	1	1	1	-	1	-	1	1	1	2	2
AVERAGE	2.33	2.33	2.33	1.67	1	1	1	0	1	0	1	1	1	2	2
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I RANDOM VARIABLES **12 Hrs**

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 **12 Hrs**

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

UNIT III TESTING OF HYPOTHESIS **12 Hrs**

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 **12 Hrs**

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

UNIT V STATISTICAL QUALITY CONTROL **12 Hrs**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np Charts) – Tolerance limits - The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions, problems.

TEXTBOOKS:

7. J. S. Milton and J.C. Arnold, ─ Introduction to Probability and Statistics‖, Tata McGraw Hill, 4th edition, 2007. (For units 1 and 2) .
8. Grewal. B.S, -Higher Engineering Mathematics‖, 40thEdition, Khanna Publications, Delhi, 2007.
9. 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 Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA401	Resistance of Ships	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester IV)		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	3. To provide the basic knowledge on Fluid and Ship interaction. 4. To know the different types of resistance, comparison laws and Model testing of ship. 5. Prediction of ship-model resistance using different methodical series.
Course Outcome	After completion of the course, the students will be able to: 1. Identify different types of resistance acting on ships. 2. Classify and interpret various types of resistance 3. Describe the model testing conducted in Towing Tank using Froude's method. 4. Summarize and analyze frictional and wave making resistance 5. Define the resistance in restricted waters 6. Compare the results of resistance by model testing and theoretical series method

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	1	1	-	1	-	-	1	2	3	3
CO2	2	2	2	2	1	1	1	-	1	-	-	1	2	2	3
CO3	2	2	2	2	1	1	1	-	1	-	-	1	1	2	3
CO4	2	2	2	1	1	1	1	-	1	-	-	1	1	2	2
CO5	3	3	3	1	1	1	1	-	1	1	1	1	1	3	2
CO6	3	3	3	1	1	1	1	-	1	1	1	1	1	2	2
AVERAGE	2.33	2.33	2.5	1.5	1	1	1	0	1	1	1	1	1.33	2.33	2.5
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1: Types of Resistance **9 Hrs**

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

UNIT II: Frictional Resistance **9 Hrs**

Frictional resistance, separation and resistance due to separation, influence of curvature of the Ship's hull, form factor. Hull roughness and its influence on frictional resistance.

UNIT III: Wave Making Resistance **9 Hrs**

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

UNIT IV: Prediction of Resistance **9 Hrs**

Model testing - tank testing facilities, testing methods, and prediction of resistance from model

tests, extrapolation, Froude's concept, laminar influence and tank wall effect, comparison of resistance prediction with results of full scale trials.
Determination of resistance from series test results - residuary resistance, effect of hull form on resistance, Statistical analysis of resistance data, Guldhammer-Harvald's and haltrop & Mennon method

UNIT V: Resistance acting on different vessel **9 Hrs**

Resistance of high speed vessels, resistance due to Superstructure, Appendage resistance, Added resistance, Resistance in restricted and non restricted waterways.

Total: 45 Hours

TEXTBOOKS:

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

REFERENCES:

1. Harvald S.A., "Resistance and propulsion of Ships", John Wiley & Son

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA402	Theory of Structures	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester IV)		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. Various method for analysis of indeterminate structures 2. Generation of stiffness matrix for various structural problems 3. Structural analysis of plate and stiffeners 4. Design and analysis of tubular members 5. Natural frequency and response evaluation of continuous system
Course Outcome	After completion of the course, the students will be able to: 1. Sketch the shear force and bending moment diagram for Indeterminate structures 2. Identify the stiffness matrix for various problems 3. Define MDOF system 4. Evaluate natural frequency and dynamic response for various systems 5. Describe critical buckling load for plate and stiffening for various loading conditions 6. Design of tubular members for pure and combined stress resultants

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO4	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO5	2	2	2	1	1	-	-	1	2	2	2	1	1	2	2
CO6	2	2	1	1	1	-	-	1	2	2	2	1	1	2	2
AVERAGE	2	2	1.8	0.3	1	-	-	1	1.7	2	2	1	1	2	2
CORRELATION LEVELS			1. SLIGHT(LOW)			2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)			

UNIT 1: Methods of Analysis for Indeterminate structure.

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

UNIT II: Stiffness matrix formulation

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

UNIT III: Dynamics

Undamped free vibration, Free Damped Vibration, Forced Vibration, MDOF system and obtaining natural frequencies

UNIT IV: Bending and buckling of plates

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

UNIT V: Tubular Member Design

Introduction- Tubular members, tubular member design, thickness of tubular member, diameter of the pipe line. Brief introduction to optimal member design.

TEXTBOOKS:

1. Timoshenko & Young; Theory of structures, McGraw Hill Publications.
2. Reddy, C.S; Basic Structural Analysis, Tata-McGraw Hill Publications. Timoshenko & Young; Theory of plates, McGraw Hill Publications.
3. Krishna Raju&Gururaja; Advanced Mechanics of solids and structures, Narosa Publications.
4. Mechanical vibrations by V P Singh

REFERENCES:

1. RD Blevins; Flow induced Vibrations, Van Nostrand Reinhold, 1990.
2. BC Gerwick, Jr. Construction of marine and offshore structures, CRC Press, 2000.
3. N Barltrop, Floating Structures, A Guide for Design and Analysis, OPL , 1998.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA407	Numerical Solution of ODE and PDE	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester IV)		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	To learn the numerical methods involving ordinary and partial differential equations
Course Outcome	After completion of the course, the students will be able to: 1. List the properties of ordinary partial differential equations 2. Identify various methods available to classify ODEs 3. Define higher order equations involving ODEs 4. Evaluate various errors and their propagation 5. Describe the classification of partial differential equations 6. Explain the elliptic and hyperbolic types of equations

POS/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 – ORDINARY DIFFERENTIAL EQUATIONS **9 Hrs**

Numerical solution of first order ordinary differential equations:Piccard's method Taylor series method,Euler and modified Euler method, Runge Kutta methods.

UNIT II – HIGHER ORDER EQUATIONS **9 Hrs**

Multi-step methods:Predictor corrector methods , Systems of equations and higher order equations. Linear Boundary value problems:Shooting methods, Finite Difference Methods

UNIT III – ERRORS AND PROPAGATION **9 Hrs**

Convergence criteria,Errors and error propagation, Stiff equations. Nonlinear Boundary Value Problems

UNIT IV– PARTIAL DIFFERENTIAL EQUATIONS **9 Hrs**

Classification, Finite Difference representation, Parabolic PDE: Explicit and implicit schemes. Compatibility,Stability and Convergence

UNIT V – ELLIPTIC AND HYPERBOLIC EQUATIONS **9 Hrs**

Hyperbolic equations – wave equation, Finite difference explicit and implicit schemes, stability 3 analysis. Methods for solving diagonal systems, Treatment of irregular boundaries. ADI and SOR schemes.

Total Hours: 45

TEXT BOOKS

1. G.D.Smith,"Numerical Solution of Partial Differential Equations : Finite Difference Methods" (Oxford Applied Mathematics & Computing Science Series).
2. R K Jain ,"Numerical Methods for Scientific and Engineering Computations": M K Jain,S R K Iyengar.

REFERENCE BOOKS

1. John Wiley,"Finite Difference methods for partial Differential equations": Forsythe G.E.& Wasow, WR. 4. Gerald, C.F.& Wheatley P.O."Applied Numerical Analysis",Pearson Education Asia.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA408	Shipyard Infrastructure & Layout	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester IV)		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. To Understand the Shipyard layout and arrangements. 2. To learn shipyard facilities and how the machines are organized. 3. To know the strategy behind shipyard infrastructure
Course Outcome	After completion of the course, the students will be able to: 1. Identify types of ships and their purposes 2. Define basic shipyard utility area 3. Describe ship construction and commissioning 4. Sketch typical production shop layouts. 5. Illustrate historically derived production data for forward planning. 6. Evaluate shop floor productivity indices.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	2	-	1	-	-	1	2	3	3
CO2	3	2	2	2	1	1	2	-	1	-	-	1	2	2	3
CO3	2	3	2	2	1	2	1	-	1	-	-	1	1	2	3
CO4	2	2	2	1	1	1	1	-	1	-	-	1	2	2	2
CO5	3	3	3	1	1	1	2	-	1	1	1	1	1	3	2
CO6	3	3	3	1	1	2	1	3	1	1	1	1	1	2	2
AVERAGE	2.67	2.67	2.5	1.5	1	1.33	1.5	3	1	1	1	1	1.5	2.33	2.5
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1: Introduction **9 Hrs**

Evolution of ship and Ship Building, Types of Ship- By Purpose and Size, Introduction to Ship Structures, Methods of Ship Building- Change in building process over time.

UNIT II: Basin Trial Area and Sea Trial area **9 Hrs**

Basic Ship yard Utility Area and its function – Steel Stock yard, Prefabrication Bay, Fabrication Bay, Assembly Bay, Hull Erection Bay, Launching Bay, Outfitting Bay. Machinery Shop. Electrical Shop

UNIT III: Ship Construction and Commissioning **9 Hrs**

Equipment requirement in different stages of Ship Construction and Commissioning – Steel /frame stock yard, Prefabrication Bay, Fabrication Bay, Assembly Bay, Hull Erection Bay, Launching Bay, Outfitting Bay, Machinery Shop, Electrical Shop, Basin Trial Area and Sea Trial area, Stores. Movable and Immovable Equipment

UNIT IV: Shipyard Layout **9 Hrs**

Shipyard Layout -Flow line in Ship Building process, Importance of process flow and reverse flow. Typical Layout of Large, Medium and Small Shipyards. Special Facilities typical to

Shipyard with Geographical constraints– Slipway, Side Launching, Synchro Lift, Air balloon launching system. HOP Concept and its Infrastructural requirement

UNIT V: Building strategy for Infrastructure **9 Hrs**

Understand the condition of infrastructure assets for Dry-dock, Slipways, Building birth etc, Technology assisting the high productivity and shipyard capacity augmentation. Assessment of socio-economic development of the coastal region.

Total: 45 Hours

TEXTBOOKS:

1. Ship Production, Prof Gokharan, IIT Kharagpur

REFERENCES:

1. Production Technology, R. K. Jain

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA403	Marine Materials and Metal Joining Techniques	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester IV)		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. To know the fundamental science and engineering principles relevant to materials used in marine field.
2. To understand the basic principles of various mechanical testing methods and NDT methods
3. To present practical knowledge of the structure and properties of metals and how these properties are affected by the heat of welding process .

Course Outcome

After completion of the course, the students will be able to:

1. Identify the core concepts in materials science to solve maritime related problems.
2. Define the contemporary issues relevant to Materials Science and Engineering.
3. Summarize various materials used in marine industry
4. Classify the materials for design and construction of marine structures
5. Categorize the NDT method
6. Interpret the results obtained from NDT methods

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	2	-	1	-	-	1	2	3	3
CO2	3	2	2	2	1	1	2	-	1	-	-	1	2	2	3
CO3	2	3	2	2	1	2	1	-	1	-	-	1	1	2	3
CO4	2	2	2	1	1	1	1	-	1	-	-	1	2	2	2
CO5	3	3	3	1	1	1	2	-	1	1	1	1	1	3	2
CO6	3	3	3	1	1	2	1	3	1	1	1	1	1	2	2
AVERAGE	2.67	2.67	2.5	1.5	1	1.33	1.5	3	1	1	1	1	1.5	2.33	2.5
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT – I CLASSIFICATION OF MATERIALS **9 Hrs**

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

UNIT – II WELDING AND WELDING PROBLEMS **9 Hrs**

General principles for welding, welding methods, welding metallurgy, welding symbol, weld design, welding procedure specifications and qualifications, pipeline welding, Different welding methods and associated defects-Weld defects, Distortion, accuracy control; Non destructive tests Welding quality control- Welding standards, Welding procedure qualification,

Effect of variables on qualification of tests, Performance Qualification of welders and operators, Test Reports. Acceptance standards, Quality assurance and audit, Consumable, classification and

coding. Knowledge of WPS and the corresponding WPQR, Welding of stainless steels. Surface preparation for steel, aluminum and other materials used in marine structures. Introduction to welding for offshore applications.

UNIT – III MATERIAL FOR CONSTRUCTION **12 Hrs**

Materials used in Marine Construction of fixed offshore structures in Marine Environment Materials used in Marine Construction of Floating structures in Marine Environment - (Floaters - permanent and mobile)

Materials used in Marine Construction of Underwater vehicles/ Remote operated Vehicle/ Remote operated tools in subsea operations and Deep water operations.

Materials used in Marine offshore drilling units'– Mooring Lines and risers both production risers, drilling risers. Flow line / pipeline / Deep water riser system/ flexible risers.

Materials used in Marine Construction of Ship and Ship structures, Boat, Launches, Composite construction of FRP/GRP, Superstructures Deckhouse structures, Aluminum, Steel - their materials involved in constructions … etc. Pipes- stainless steel, seamless pipes, Fabricated pipes, PVC, Properties of Structural elements/ section materials, construction materials, Propeller, Rudder, Anchor chain cable Hawse pipe, etc. Classification Society rules for Materials, Outfitting Material of ship and floaters.

Selection of materials and fabrication control of steel structures Selection of materials and fabrication control of aluminum structures

Selection of materials and fabrication control of concrete structures and steel structures

Corrosion protection of structures and Condition monitoring of structures

UNIT – IV WELDING PROCESS Plates profiles and pipes **9 Hrs**

Gas metal arc welding - process, different metal transfers, power source, electrodes, shielding gas, uses of gas in metal arc welding, Mechanized system in shipbuilding - Introduction, Philosophy of automation in welding, different welding system on shipyards, welding in production shop - SAW. Gravity, welding, Auto contact, CO2 Welding

UNIT – V PANEL LINE PRODUCTION **6 Hrs**

Welding in - building berth, Dry-dock, slipways, hull shops, Internal welding on the berth. NDT Procedures and Methods, Acceptance Standards and Documentation of NDT procedures.

TEXTBOOKS:

1. V Raghavan -Material Science and Engineering, Prentice Hall of India (P) Ltd, NewDelhi
2. Hanson - The Engineer's Guide to Steel, Addision - Wesley publication Company, Inc
3. Davies, A.S.; Welding Cambridge University Press, Low Price Edition, 1996:
4. Richard, little; Welding Technology, McGraw Hill Publications, New Delhi.
5. Joe Lawrance; Welding Principles for Engineers, Prentice - hall Inc. Englewood cliffs, N.J.

REFERENCES:

1. Welding Handbook - Vol. 1, 2, 3,;
2. American Welding Society AWS
3. O.P.Khanna; A Textbook of Welding Technology, DhanpatRai& Sons.
4. AWS D1.1 - Structural Steel Code: 2010 Edition- code clinic available (codebook provided for D1.1 week seminar participants only)
5. API 1104 - Pipelines 20th Edition (code clinic available) with Errata /Addendum July 2007, Errata 2 December 2008

6. AWS D1.2 - Structural Aluminum Code: 2003 or 2008 Edition 7. AWS D1.5 - Bridge Welding Code: 2008 Edition 8. ASME Sec IX: 2010 Edition w/ 2011 Addenda, B31.1 & B31.3 2010 Editions 9. ASME Sec VIII (Div 1) & ASME Sec IX: 2007 Editions with 2008 Addenda 10. AWS Publications	
Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA404	Strength of Ships	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester IV)		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. To determine various loads and framing arrangement of ship
2. To determine the section modulus and scantling calculations
3. To learn basics of ship vibration and methods to determine the dynamic response

Course Outcome

After completion of the course, the students will be able to:

1. Extract various loads acting on ship under various conditions
2. Sketch shear force and bending moment diagram for ship in still water and wave loading conditions
3. Describe basic statistical analysis for ships
4. Define section modulus and scantling calculations for ship.
5. Solve basic calculations for transfer function and frequency domain
6. Use natural frequencies of SDOF and MDOF system and methods to obtain response analytically.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	-	1	-	-	1	2	2	2
CO2	2	2	2	2	2	1	2	-	1	-	-	1	2	2	3
CO3	2	3	2	2	2	2	1	-	1	-	-	1	1	2	1
CO4	2	2	2	1	1	1	1	-	1	-	-	1	2	2	1
CO5	2	3	3	1	1	1	2	-	1	1	-	1	1	1	2
CO6	2	3	3	1	1	2	1	-	1	1	-	1	1	1	2
AVERAGE	2.0	2.5	2.33	1.5	1.5	1.3	1.5	0	1.0	1.0	0	1.0	1.5	1.67	1.83
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1: Various Loads on ship and Loading Distribution **9 Hrs**

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

UNIT II: Shear force and Bending Moment calculations **9 Hrs**

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

UNIT III: Calculation of loads and response in irregular seaway (Introduction) **9 Hrs**

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

UNIT IV: Strength and Scantling Calculations **9 Hrs**

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

UNIT V: Analytical method to obtain vibrations and Special topics **9 Hrs**

Introduction to vibration: – Sources of vibration, measures to control vibration, methods to determine natural frequency, Stodala iteration; Special Topics - Strength of superstructure and deckhouses Longitudinal strength during launching and docking

Practicals:

Longitudinal strength calculation

Transverse strength calculation

Total: 45 Hours

TEXTBOOKS:

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 Vibrarions by V.P Singh

REFERENCES:

1. Mechanics of Materials, James M. Gere, Stephon P. Temoshenko

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UAMCC02	Design of Machine Elements	L	T	P	C
		3	0	0	3

Year and Semester	II Year (semester IV)	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. To understand the standard procedures for design of various machine components
2. To learn various methods available in design of various machine elements
3. To learn the usage of standard practices and data

Course Outcome

After completion of the course, the students will be able to:

1. Identify the design process and various stresses & strains due to different loading conditions.
2. Describe the design procedure for curved beams, shafts and couplings will be learnt.
3. Explain the procedure for designing different types of joints.
4. Interpret the design of energy storing elements like flywheels and springs
5. Relate various types of bearings and miscellaneous elements like connecting rod.
6. Categorize various methods available in design of machine elements

POS/COS	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2	PSO 3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO4	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO5	2	2	2	1	1	-	-	1	2	2	2	1	1	2	2
CO6	2	2	1	1	1	-	-	1	2	2	2	1	1	2	2
AVERAGE	2	2	1.8	0.3	1	-	-	1	1.7	2	2	1	1	2	2
CORRELATION LEVELS			1. SLIGHT(LOW)			2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)			

UNIT 1: STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS **9 Hrs**

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties -- Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and ‗C' frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relation

UNIT 2: DESIGN OF SHAFTS AND COUPLINGS **9 Hrs**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys, key ways and splines - Design of crankshafts -- Design of rigid and flexible couplings.

UNIT 3: DESIGN OF TEMPORARY AND PERMANENT JOINTS **9 Hrs**

Threaded fasteners - Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of welded joints, riveted joints for structures - theory of bonded joints.

UNIT 4: DESIGN OF ENERGY STORING ELEMENTS **9 Hrs**

Design of various types of springs, optimization of helical springs -- rubber springs -- Design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT 5: DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS **9 Hrs**

Sliding contact and rolling contact bearings – Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, — Selection of Rolling Contact bearings.

Total: 45 Hours

TEXTBOOKS:

1. Shigley J.E and Mischke C. R., -Mechanical Engineering Design‖, Sixth Edition, Tata McGraw-Hill , 2003.

REFERENCES:

2. Bhandari V.B, -Design of Machine Elements‖, Second Edition, Tata McGraw-Hill Book Co, 2007.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA4PA	Ship design calculation drawing & drafting II (SDCADD II)	L	T	P	C
		0	0	3	1

Year and Semester	II Year (semester IV)		Contact hours per week (45Hrs)	
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 perform damaged stability calculations 3. To perform structural calculations
Course Outcome	After completion of the course, the students will be able to: 1. Evaluate various hydrodynamic calculations in ship 2. Sketch the hydrostatic curves manually and in software 3. Explain the floodable length calculation 4. Compare the results obtained for hydrostatics with available software 5. Sketch Bonjean curves manually and in AutoCAD 6. Sketch types of outfitting equipments & the corresponding arrangements

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	2	2	1	1	2	2	1	2	3	2
CO2	2	2	2	1	1	2	2	1	1	2	2	1	1	3	3
CO3	2	2	2	1	1	2	2	1	2	2	2	1	2	2	2
CO4	2	2	2	1	1	2	2	1	2	2	2	1	2	2	2
CO5	2	2	2	1	1	2	2	1	2	2	2	1	1	2	2
CO6	2	2	1	1	1	2	2	1	2	2	2	1	1	2	3
AVERAGE	2.0	2.0	1.83	1.0	1.0	2.0	2.0	1.0	1.67	2.0	2.0	1.0	1.5	2.33	2.33
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)				

UNIT 1:HYDROSTATIC CALCULATION & CURVES

Hydrostatic particulars, calculation of hydrostatics, plotting of hydrostatic particulars in graph

UNIT II: BONJEAN CURVES

Calculation of bonjean curves & plotting it manually and in Auto CAD

UNIT III: FLOODABLE LENGTH CALCULATION & CURVES

Floodable length calculation, drawing floodable length curve both manually and in software

UNIT IV: STRUCTURAL CALCULATIONS

Shear force and Bending moment calculation of mid-ship, Scantlings

Total: 45 Hours

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UAME4PB	Marine Engineering Laboratory	L	T	P	C
		0	0	2	1

Year and Semester	II Year (semester IV)		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 various parts of marine engines and its operations
Course Outcome	After completion of the course, the students will be able to: 1. Identify marine engines 2. Define various parts of a marine engine 3. Describe various parts of marine engine 4. Observe various operations of main engine 5. Analyze the results obtained from the engine test 6. Identify air system components, construction details of generators

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	-	1	-	-	1	2	2	2
CO2	2	2	2	2	2	1	2	-	1	-	-	1	2	2	3
CO3	2	3	2	2	2	2	1	-	1	-	-	1	1	2	1
CO4	2	2	2	1	1	1	1	-	1	-	-	1	2	2	1
CO5	2	3	3	1	1	1	2	-	1	1	-	1	1	1	2
CO6	2	3	3	1	1	2	1	-	1	1	-	1	1	1	2
AVERAGE	2.0	2.5	2.33	1.5	1.5	1.3	1.5	0	1.0	1.0	0	1.0	1.5	1.67	1.83
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

LIST OF EXPERIMENTS

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

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

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

(a) L O Pressure

(b) S W Temperature

(c) F W Temperature

(d) Exhaust Temperature

(e) Engine Room

(f) L O temperature

2. Starting Air System, Tracing of air system, Valves, Main engine Starting Air valve, Air bottles and its arrangements

3. Study/identify lifting arrangement of Main Engine
4. Identification of Construction Details ship generator, Installation details of Prime mover, and alternator, M SB parts, Power distribution system, Starting and stopping checks of generator
5. Run the generator and take it in load. Note down various parameters. Stop generator after observing stopping checks of generator
6. Undestanding the details of starting air compressor. Reading the air system line from air compressor to air bottle. Makin note of materials of system pipes with valve details"

Total: 30 Hours

Reference Books

1. Harrington; Marine Engineering, SNAME Publications
2. Pounder C.C; Marine Diesel Engines, Newnen - Butterworths, London.
3. Khetagurov, M; Marine Auxiliary Machinery and systems, Peace Publishers, Moscow.
4. Taylor, D.A.; Introduction to Marine Engineering
5. Reed's Marine Engineering for Naval Architect
6. Marine Pumps and Piping Systems.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UAMCCPG	Strength of Materials Laboratory	L	T	P	C
		0	0	2	1

Year and Semester	II Year (semester IV)		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	To demonstrate 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. Identify various equipment's for testing strength of materials 2. Extract the results obtained from the various test 3. Compare the results obtained from the results 4. Analyze and plot the results obtained from various tests 5. Use and operate various equipment's used for strength of materials 6. Conduct the test on a machine and analyze the data obtained.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	2	1	1	2	2	1	2	2	2
CO2	3	2	2	2	1	2	2	1	1	2	2	1	1	3	3
CO3	2	2	2	1	2	2	2	1	2	2	2	1	2	2	2
CO4	2	2	2	1	2	2	2	1	2	2	2	1	2	2	2
CO5	2	2	2	1	1	2	2	1	2	2	2	1	1	2	2
CO6	2	2	1	1	1	2	2	1	2	2	2	1	1	2	3
AVERAGE	2.33	2.17	1.83	1.33	1.33	2.0	2.0	1.0	1.67	2.0	2.0	1.0	1.5	2.17	2.33
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. Three point Bend test.
7. Ultimate tensile test of metallic materials.
8. Deflection test of beams made of different materials.
9. Fatigue test of Ductile materials.
10. Compression test on helical springs
11. Torsion test on mild steel rod Fatigue test on mild steel
12. Compression test on a Bricks

Total: 30 Hours

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	B.E (NAVAL ARCHITECTURE & OFFSHORE ENGINEERING)					
Course Code UALECPE	Course Name Soft skills - IV		L 2	T 0	P 2	C 2
Year and Semester	II Year & IV 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	Knowing the corporate culture and the professional ethics Preparing them to achieve their organizational goals
Course Outcomes	After successful completion of 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.

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				SLIGHT (LOW)				MODERATE (MEDIUM)				SUBSTANTIAL (HIGH)			

UNIT1: GRAMMAR AND FOUNDATON **6 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.

UNITII: PROFESSIONALETHICS : **6 Hrs**

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: INTERACTIVE ENGLISH **6 Hrs**

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: LISTENING AND SPEAKING **6 Hrs**

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

UNIT V: WRITTEN ENGLISH **6 Hrs**

Write a summary of short lectures on familiar topics by making / taking notes- Views expressed in a discussion. Writing an Informal Letter on a situation /Descriptive Paragraph (person/place/event/diary entry)

TOTAL: 30 HOURS

TEXT BOOKS:

3. Essential Grammar in use- Raymond Murphy ,Cambridge , New Third Edition
4. Communication skills

REFERENCE BOOKS:

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

SEMESTER V

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCNA501	Wave Hydrodynamics	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester V)		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. Understand the mechanics of water waves 2. Understand the waves deformation and currents 3. Understand the irregular waves and forces
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the appropriate wave theories 2. To apply the basic physical principles of the ocean and coastal environments 3. To relate the met ocean conditions based on wave data 4. To use the extreme sea condition for input to design of structures. 5. To discuss the wave forces on structures. 6. To state the irregular waves and forces

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	1	1	2	2	1	2	2	2	1	1	2	2
CO4	3	3	2	1	2	2	2	2	3	3	3	2	2	2	2
CO5	3	3	2	2	2	2	1	2	3	3	3	2	2	2	3
CO6	2	3	2	2	2	1	1	1	2	2	3	2	1	3	3
AVERAGE	2.33	2.50	2.00	1.50	1.50	1.75	1.50	1.33	2.00	2.33	2.50	1.50	1.33	2.17	2.33
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1: WATER WAVES **9 Hrs**

Fluid mechanics basics, Wave s- Definition of wave parameters, classification of water waves, the sinusoidal wave profile, some useful functions and numerical methods

Two-dimensional wave equation and wave characteristics, Wave theories – Linear wave theory – Small amplitude wave theory

UNIT II: SMALL AMPLITUDE WAVES **9 Hrs**

Small amplitude wave theory – introduction, wave length and period, wave dispersion, wave table, water particle kinematics, water particle displacements, group celerity, wave energy and power, Sub surface pressure

UNIT III: FINITE AMPLITUDE WAVES **9 Hrs**

Non-linear waves – Introduction, finite amplitude waves, Wave steepness, Non-linear wave theory - Stoke‘s wave theory , Cnoidal wave theory, Solitary wave theory, Stream function wave theory ,validity of wave theories

UNIT IV: WAVE DEFORMATIONS AND CURRENTS **9 Hrs**

Wave deformation – Wave Refraction, Wave diffraction, Reflection, and breaking of waves Water Currents –Introduction, Classification, Wave current interaction, effects of currents

UNIT V: CHARACTERISTICS OF IRREGULAR WAVES **9 Hrs**

Irregular waves- Introduction, ocean wave analysis methods, spectral method, statistical methods and parameters, sea

state, Probability distributions for a sea state Examples of frequency spectra and spectral parameters, Directional spectra, Random wave simulation, kinematics and dynamics of irregular waves

TOTAL: 45 Hours

TEXT BOOKS

1. Introduction to Near shore Hydrodynamics
   Water wave mechanics for engineers and scientists by Robert G Dean and Robert A Dalrymple
3. Coastal Hydrodynamics -Mani J.S (2011) PHI Learning Pvt. Ltd
4. Water waves and ship hydrodynamics by Hermans , A.J.

REFERENCE BOOKS:

1. Airy, G.B. 1845. Tides and waves , Metrop ,article 192
2. Chakrabarti S.K .1987. -Hydrodynamics of offshore structures -. WIT Press , Southampton , UK.
3. An introduction to hydrodynamics and water waves BY Bernard LeMehaute, 1976 Springer Verlag

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA501	Propulsion of Ships	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester V)		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. To enable the students to acquire knowledge in the concepts of ship propulsion 2. To familiarize the students with various types of ship propulsion system
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the fundamental aspects of ship propulsion. 2. To judge the propeller design concepts 3. To compare the hydrodynamic and strength part of propeller. 4. To interpret the design features 5. To describe the propulsion devices 6. To define the propulsion and propulsion devices

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO4	3	2	2	-	1	2	1	1	2	2	2	2	1	2	2
CO5	2	2	2	1	2	2	1	2	3	2	2	2	2	3	3
CO6	2	3	2	2	2	2	2	2	3	3	2	2	2	3	3
AVERAGE	2.16	2.16	2.00	1.50	1.33	2.00	1.33	2.66	2.00	2.16	2.00	1.50	1.33	2.33	2.33

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

UNIT I Basics of propulsion **9 Hrs**

Propeller as a thrust producing mechanism; historical development; Screw propeller screw propeller geometry, sections, propeller drawing, construction details.

Propeller theories- Momentum theory, Blade element theory, Circulation theory.

Interaction between Hull and Propeller - Wake and wake fraction, Resistance augment and thrust deduction factor, propulsive efficiency in open water and behind conditions, hull efficiency, quasi propulsive coefficient, transmission efficiency; Powering.

UNIT II Propeller design **9 Hrs**

Cavitation - Types, Cavitation Number, Effects of cavitation, Prevention of cavitation, Design for minimum cavitation, Cavitation tests.

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

UNIT III Strength Calculation **9 Hrs**

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

UNIT IV Design Aspects **9 Hrs**

Shrouded propellers-Action of propeller in a nozzle; wake fraction and thrust deduction fraction in nozzle, load factor of nozzles, design of propeller nozzle system, design charts.

Controllable Pitch propellers-Advantages, special features in geometry, design aspects. Super cavitating propellers-application

UNIT V Propulsion System **9 Hrs**

Diesel Engine, Wind Propulsion, Electric Propulsion, Solar powered, Water jet propulsion,
Ship standardization trials

Total: 45 Hours

TEXT BOOKS

1. Lewis, E.U; 'Principles of Naval Architecture' (2nd Rev.) Vol. 2, 1989, SNAME New York
2. Harvald S.A.; "Resistance and Propulsion of Ships", John Wiley & Sons., 1983
3. Ghose,J.P and Gokarn,R.P, "Basic Ship Propulsion", Allied Publishers, 2004
4. Tupper,E.C;Introduction to Naval Architecture, Butterworth-Heinemann,Ã‚Â 1998.

Carlton J, Marine Propellers and Propulsion, Elsevier 2007

REFERENCE BOOKS:

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

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA502	Marine Design	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester V)		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. Understand the marine activities 2. Know the parameters in ship design 3. Understand the ship system design
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the marine activities and cost aspects in ship design 2. To weigh the design factors 3. To examine the parameters in ship design 4. To demonstrate the general arrangement in ship design 5. To recognize the different ship system 6. To define the ship system design

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	3	3	1	1	1	-	1	2	2	2	1	1	2	2
CO4	3	3	2	1	2	1	1	2	2	3	2	1	1	2	3
CO5	3	3	3	1	2	1	1	2	2	3	3	2	2	3	3
CO6	3	2	1	1	1	1	1	2	2	3	2	2	1	3	3
AVERAGE	2.50	2.50	2.17	1.00	1.33	1.00	1.00	1.50	1.67	2.50	2.17	1.33	1.17	2.33	2.50

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

UNIT 1: INTRODUCTION **9 Hrs**

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

UNIT II: SHIP DESIGN **9 Hrs**

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

UNIT III: PARAMETERS IN SHIP DESIGN **9 Hrs**

Ship dimension -length, breadth, depth, draught, form coefficients; shape of the hull, mass estimation - lightship mass - steel mass, outfit mass, engine plant mass; dead weight.

Design of hull form - conventional method of lines, distortion of existing forms; stem and stern contours, Bulbous Bow.

UNIT IV: GENERAL ARRANGEMENT **9 Hrs**

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

UNIT V: MARINE SYSTEM DESIGN **9 Hrs**

Marine System Design: Bilge and Ballast system, Ventilation system, Air conditioning and Refrigeration system, Berth and Offshore Mooring systems, Anchor handling system for ships and shore structures, windlass, Capstan, storage and offloading systems, Fire-fighting system, Stern gear, Steering gear, Rudder, Lifesaving equipment.

TOTAL:45 Hrs

TEXT BOOKS

1. Marine design by Thomas C Gilmer
2. Marine design by Mariana Vasquez

REFERENCE BOOKS:

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

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA504	Ship Production	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester V)		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. Understanding of the construction of a mid-ship section. 2. How shipyard facilities and machines are organized. 3. The manner in which these influence the various production stages.
Course Outcome	After completion of the course, the students will be able to: 1. To develop a pattern of shipbuilding 2. To weigh the labor, material, machine and space resource requirements. 3. To compare productivity, ship efficiency and machine utilization figures. 4. To solve the activity networks for planning purposes. 5. To classify the impact of some production activities 6. To define the assembly procedure of ship production

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	2	1	-	1	1	2	2	2	1	1	2	2
CO4	2	3	2	2	1	2	1	1	2	3	2	1	2	2	2
CO5	3	3	2	2	2	2	2	2	3	3	3	2	2	3	3
CO6	3	3	2	1	2	1	2	2	3	3	3	2	2	3	2
AVERAGE	2.33	2.50	2.00	1.75	1.33	1.67	1.50	1.33	2.00	2.50	2.33	1.33	1.50	2.33	2.17

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

UNIT – I: CONCEPS IN SHIP BUILDING **9 Hrs**

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

UNIT – II: DATA GENERATION **9 Hrs**

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

UNIT – III: FABRICATION **9 Hrs**

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

UNIT – IV: ASSEMBLY **9 Hrs**

Assembly of Ship's Structure: Prefabrication - general remarks, basic problems of prefabrication, pattern of prefabrication, welding in prefabrication

Sub-assemblies: built up T -bars, web frames, machine foundations etc.; Welding deformation and straightening; Prefabrication of flat sections - panels,' panel production line, preassembly of biaxial stiffened panels - welding procedures. Assembly of flat corrugated sections, flat sections with curvature - assembly jigs, welding process, its nature, theoretical background, strengthening of flat sections. Preassembly of volume units - preassembly of double bottom sections - different structural arrangements, variants of the assembly process, welding problems; Preassembly of side tank units - structural

arrangement; Special assembly systems (ROTAS, GAMMA- Systems, etc.); Preassembly of the fore and aft end structure; Preassembly and outfit of superstructures.

UNIT – V: ERECTION AND LAUNCHING **9 Hrs**

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

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

Testing of materials and methods of Destructive testing, Non Destructive Test

Total: 45 Hours

TEXT BOOKS

4. Taggart; Ship Design and Construction, SNAME
5. StorchR.Lee, Hammon C.P. & Bunch H.M.; Ship Production, Cornell Maritime Press, Maryland, USA, 1988

REFERENCE BOOKS:

1. Dormidontov V.K. & et.al; Shipbuilding Technology, Mir Publishers, Moscow.
2. Eyres D.J.; Ship Construction William Heinemann Ltd, London, 1982

Designed by	“ Department of Naval Architecture & Offshore Engineering”

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA505	Ship Repair & Conversion Technology	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester V)		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. Understanding of the construction of a mid-ship section. 2. Understand the shipyard facilities and mechanization. 3. Understand the manner in which resources influence the production stages.
Course Outcome	After completion of the course, the students will be able to: 1. To develop ship repair strategy 2. To define the berth preparation for ship repair 3. To compare the labor, material, machine and space resource requirements. 4. To demonstrate the productivity and machine utilization figures. 5. To discuss the activity networks for planning purposes. 6. The state the impact of production activities on planning and management functions.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	1	1	-	-	1	2	2	3	1	1	2	2
CO4	2	3	3	1	2	2	2	2	3	3	3	2	2	3	3
CO5	3	3	2	2	2	2	1	2	3	3	2	2	2	3	3
CO6	3	3	2	2	2	1	1	1	3	2	2	1	2	3	3
AVERAGE	2.33	2.50	2.17	1.50	1.50	1.67	1.33	1.33	2.17	2.33	2.33	1.33	1.50	2.50	2.50

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

UNIT-I INTRODUCTION **9 Hrs**

Introduction to ship repair industry, Steel work, Mechanical work, Electrical works, General works, Tank cleaning, Tank testing, Light ship survey, Inclining experiment, Pipe Purging, Laser Scanner for Ballast Water Installation, Flash light cuts inspection

UNIT-II DRY DOCKING REPAIR **9 Hrs**

Berth preparation , Docking and undocking ,Shifting of Blocks after docking the vessel, Dock Services, Hull preparation, Hull Panting Rudder works, Removal of rudder and stock surveys, Propeller polishing at site, Tail shaft works, Tail shaft stern tube clearance, Removal of tail shaft for survey, Glands and seals (Simplex type), Sea chest, Anodes in hull and in sea chest, Sea valves, ship side storm valves, docking plugs, valves, Fenders and hollow fenders, Anchors and cables.

UNIT-III CAPACITY PLANNING **9 Hrs**

Estimation of future capacity of ship conversion methods, strategies for modifying capacity, models for capacity planning under the special conditions of ship repair and conversion. Work completion, Dry survey, Inspection and commissioning of shipboard Piping systems and Equipments.RO-RO Conversion.

UNIT-IV CONVERSION STANDARDS **9 Hrs**

Conversion standards – Conversion standards in several parts of the ship Conversion process. Work measurement systems, methods of man - hour determination, use of computers, correlation between size of series and needed man – hours. Systems of maintenance and quality control. FPSO, FSO, FSU Conversion – Inquest producer, Conversion of processing plant, Conversion of boilers and stream turbines, conversion of turret and mooring systems, complete overhaul of the engine plant, modernise of electrical and alarm systems, Crew accommodation spaces, Modernise helicopter deck

UNIT-V SHIP REPAIR STANDARDS AND BEST PRACTICES **9 Hrs**

Overlook on various standards for ship repair, Guidelines of classification society, IACS Ship repair Standards and Best Practices, Coatings – IMO standards, ISO Documentation, Document management, Repair Invoice and settlement, Reports and record Keeping.

Total: 45 Hours

TEXT BOOKS

1. Taggart; ship design and construction, SNAME chapter 15, 1980
2. Storch R. Lee, Hammon C.P. & Bunch H.M..; Ship Production, Cornell Maritime Press, Maryland, USA, 1988
3. Dormidontov V. K. & et.al; Shipbuilding Technology, Mir publishers, Moscow.
4. Eyres D.J.; Ship Construction William Heinemann Ltd, London, 1982
5. Buffa, Modern production operations management, 6th edition, Wiley 1980
6. C/WP6(2008)6 Council working party on ship building
7. Ship repair and conversion technology – A Publication of The Royal Instituton of Naval Architects.www.rina.org.uk/srct

REFERENCE BOOKS:

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

AWS Publications

1. Certification Manual for Welding Inspectors CM: 2000
2. Welding Inspection Handbook WI: 2000

* D1.1/D1.1M Structural Welding Code-Steel D1.1/D1.1M: 2010

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA506	Corrosion and Protection Engineering	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester V)		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. To evaluate corrosion life and select suitable methods of corrosion protection 2. To familiarize the different marine construction materials 3. To understand the NDT testing and SHM of marine structures
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the corrosion of materials used in marine field 2. To weigh the corrosion protection methods 3. To examine the different protective coatings 4. To interpret use of lightweight materials in marine construction 5. To identify the NDT testing of marine structure 6. To memorize the corrosion and protection of marine structures

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO4	3	2	2	-	1	1	2	1	2	2	2	1	1	2	3
CO5	3	3	3	1	1	2	2	2	2	3	2	2	1	3	3
CO6	3	3	2	2	1	2	1	2	3	3	3	2	2	3	3
AVERAGE	2.50	2.33	2.17	1.50	1.00	1.67	1.67	1.33	1.83	2.33	2.17	1.33	1.17	2.33	2.50

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

UNIT I : MATERIALS **9 Hrs**

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 : COATINGS **9 Hrs**

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

UNIT III : PROTECTION **9 Hrs**

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 : COMPOSITES **9 Hrs**

Introduction to composites for marine environment

UNIT V : DESTRUCTIVE AND NON-DESTRUCTIVE TESTING **9 Hrs**

Testing of materials and methods of Destructive testing, Non Destructive Test – Visual Inspection, Liquid Penetration Test, Radiographic Test – Introduction, principle, X-Ray radiography procedure, gamma ray, Magnetic Particle Test, Ultrasonic Test.

Total: 45 Hours

REFERENCE BOOKS:

1. Hsu, H.T. 1981.Applied Offshore Structural Engineering: Gulf Publishing Co., Houston
2. API-RP2A. 1989. Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms: 18th edn. American Petroleum Institute, Washington, D.C.
3. Corrosion and Protection, Engineering, ISSN 1619-0181, Springer Science & Business Media, 2004
4. Handbook of Cathodic Corrosion Protection

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	HULL SURVEY & HULL HEALTH MONITORING	L	T	P	C
UANA507		3	0	0	3

Year and Semester	III Year (semester V)		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. To understand the various types material used in ship building 2. To understand strength analysis. 3. To understand the different hull protection system
Course Outcome	After completion of the course, the students will be able to: 1. To formulate the different materials used in marine construction 2. To value corrosion life and select suitable methods of corrosion protection 3. To examine the requirement for periodic survey of the hull structure 4. To demonstrate the structural standards followed in hull maintenance 5. To explain the various hull protection system 6. To define and evaluate the hull structure

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	3	2	2	-	1	1	1	1	2	2	2	1	1	2	2
CO4	3	3	3	2	1	1	2	2	2	2	2	2	1	2	3
CO5	3.0	3.0	2.0	1.0	1.0	1.0	2.0	2.0	1.0	3.0	3.0	2.0	2.0	3.0	3.0
CO6	2.0	2.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	3.0	3.0	2.0	2.0	3.0	3.0
AVERAGE	2.5	2.3	2.0	0.7	1.0	0.7	1.0	1.5	1.5	2.3	2.3	1.5	1.3	2.3	2.5
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1 OPERATION CYCLE **9 Hrs**

Types of Ship; Operation Cycle of Ships. Overview of Materials for Shipbuilding; An overview of Material property, Types of Ship building Steel. Marine Environment; Effects of Marine environment. Corrosion and its effect on Hull.

UNIT II HULL STRUCTURE **9 Hrs**

Hull Structure – Types of Hull, Concept of Hull as a simple beam; Loads, Forces, Stresses and Moments that act on ship‘s Hull in seaway; Introduction to mid-ship section and its relevance in Ships structural strength; Scantling of ship and its relevance in overall strength of ship. Lines plan and shell expansion drawing.

UNIT III HULL SURVEY **9 Hrs**

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 IV STANDARDS **9 Hrs**

Hull Structural standards, IACS standards, Ship Building Standards. Ship Repair Standards. Defining the hull defect and prescribing corrective action. Relevance 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

UNIT V CORROSION PROTECTION **9 Hrs**

Hull Corrosion Protection System Fundamentals of protective coating, its defects and effects. 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 Preferential corrosion, Galvanic Cell, Sacrificial Anodes - Types, ICCP system. Underwater Hull survey, Survey of Sacrificial Anodes

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

REFERENCE BOOKS:

1. PURSEY,H.J , Merchant ship construction ,2002

Designed by	"Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Marine Transportation and Engineering Economics	L	T	P	C
UANA508		3	0	0	3

Year and Semester	III Year (semester V)		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. Understand the cargo transportation process 2. Identify the shipping routes 3. Understand the shipping policy
Course Outcome	After completion of the course, the students will be able to: 1. To develop transportation system 2. To value economics of transport management 3. To differentiate the shipping routes 4. To demonstrate the microeconomics approach 5. To discuss transport policy 6. To define the transport management and the docking activities

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	2	1	-	-	1	2	2	2	1	1	2	2
CO4	2	2	3	2	1	2	1	1	3	2	2	1	2	2	2
CO5	3	3	3	1	1	2	2	1	3	3	3	2	2	3	3
CO6	2	2	1	1	1	1	1	1	2	2	2	3	1	2	3
AVERAGE	2.17	2.17	2.17	1.50	1.00	1.67	1.33	1.00	2.00	2.17	2.17	1.50	1.33	2.17	2.33

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

UNIT – I SHIPS AND CARGOES **9 Hrs**

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 TRANSPORT MANAGEMENT **9 Hrs**

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 ROUTING **9 Hrs**

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 SUPPLY **9 Hrs**

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 POLICY **9 Hrs**

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)

Latest changes in the policy, Applicability of the policy for international trades

Total: 45hours

TEXT BOOKS

1. Emile Quinet and Roger Vickermand, Principles of Transport Economics, EE publication
2. Pradeepta Kumar Samanta, Port Infrastructure and economic development, Kalpaz publ. (Delhi)

REFERENCE BOOKS:

1 Gust Baluwens, Peter De Baere, Eddy Van de Voorde, ─ Transport Economics, De boeck publication
2 Classification society rules-Indian registrar of shipping
3 Institute of chartered ship brokers-tutorship London
4 Shipping practice-EF stevens and CSI butterfield

Designed by	"Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA509	Cost Estimation Tendering for Shipbuilding & Allied Industry	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester V)		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. To understand the economic aspects of shipbuilding 2. To understand the technical features of design optimization 3. To understand the safety management concept of ship design			
Course Outcome	After completion of the course, the students will be able to: 1. To develop cost estimation and tendering of shipbuilding projects 2. To select design optimization for different speed combination 3. To relate different technical and economic features of design 4. To implement the safety management concepts 5. To identify the legal and financial aspects of shipbuilding 6. To define the ship design and alternate maritime designs			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO4	3	2	2	-	1	1	2	2	2	2	3	2	1	2	3
CO5	2	3	2	1	1	2	1	2	3	1	2	1	1	3	3
CO6	3	3	2	2	1	2	1	1	3	1	3	2	1	3	3
AVERAGE	2.33	2.33	2.00	1.50	1.00	1.67	1.33	1.33	2.00	1.67	2.33	1.33	1.00	2.33	2.50

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

UNIT I: COST ESTIMATION **9 Hrs**

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

UNIT II : CHARTERING **9 Hrs**

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

UNIT III: ECONOMIC FEATURES **9 Hrs**

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

UNIT IV : SAFETY MANAGEMENT **9 Hrs**

Safety management concept in ships and ports and ISO certifications.

UNIT V: MANAGEMENT PRACTICES FOR PROJECTS **9 Hrs**

Overview about international laws for trading, Management practices :Commercial , Marketing, Legal and financial aspects of shipbuilding and shipping

TEXT BOOKS

1. Shipbuilding Cost Estimation Parametric approach by Haakon Shetelig
2. Cost Management in Shipbuilding Planning, Analysing and Controlling Product Cost in the Maritime Industry by Jan O. Fischer

REFERENCE BOOKS:

1. Updating MIT's Cost Estimation Model for Shipbuilding by Matthew B. Smith

Designed by	"Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	SHIPYARD	L	T	P	C
UABS508	MANAGEMENT/PRACTICES	3	0	0	3

Year and Semester	III Year (semester V)		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. Understand the various ship types and different stages in design 2. Provide exposure and inputs on general management of shipyard 3. Understand the best practices for productivity, quality & safety
Course Outcome	After completion of the course, the students will be able to: 1. To develop the shipyard processes requirement 2. To judge the design approval and production needs of shipyard 3. To examine the existing capacity of the yard 4. To implement the improvement on better practice for quality, product & safety 5. To discuss the Shipyard Layout and Infrastructure 6. To list the people skill and management relationship

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	2	1	2	2	2	1	1	2	2
CO4	2	3	3	1	2	2	2	2	3	3	3	2	3	3	2
CO5	3	3	3	2	2	1	2	2	2	3	3	2	3	3	3
CO6	3	2	3	2	2	1	1	2	1	3	1	2	2	2	3
AVERAGE	2.33	2.33	2.50	1.67	1.50	1.33	1.75	1.50	1.67	2.50	2.17	1.50	1.83	2.33	2.33

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

UNIT 1 INTRODUCTION **9 Hrs**

Overview of the entire marine business, the various types of ships available, different markets for ship, financial issues and their correlation to shipyard operations. Various stages of a shipbuilding contract and the main processes requirement. Different stages in ship design - early contract design, procurement issues, post contract, ship functions, design approval and production needs

UNIT 2 SHIP REPAIR **9 Hrs**

Defining Ship construction, ship repair and conversion activities – comparison and Contradictions (differences between) Typical Organisation Structure of Shipyards – Function of each section / Department.

Critical role play of – Production, Planning, Quality Assurance, Material and Stores requirement, EHS and Housekeeping, Yard Utility and Maintenance, Marketing and Finance.

UNIT 3 PLANNING AND STRATEGIES **9 Hrs**

Appropriate planning & strategies for different stages and events shipyard projects. Ship construction project scheduling and critical role of procurement. Tools used in Project monitoring and Planning

UNIT 4 PRODUCTION PROCESS **9 Hrs**

Managing various shipyard production processes effectively - steel structure production, material cutting & forming, unit and block assembly, machinery and hull outfitting, system testing and commissioning. Shipyard Layout and Infrastructure. Monitoring project progress closely and manage a successful project handover upon completion and commissioning.

UNIT 5 STANDARDS AND SHIPYARD MANAGEMENT **9 Hrs**

Overlook on various standards for ship repair, Guidelines of classification society, IACS Ship repair Standards and Best Practices, Coatings – IMO standards.

Management Styles- Executive / Authoritative, Participatory, Consensus; Leadership styles. People Skill/ Relationship management.

Total: 45 Hours

TEXT BOOKS

1. Jessie Riposo (Author), Brien Alkire (Author) U.S. Navy Shipyards: An Evaluation of Workload- and Workforce-Management Practices
2. NATIONAL STEEL AND SHIPBUILDING CO SAN DIEGO CA (Author)- The National Shipbuilding Research Program. Air Quality Best Management Practice (AQBMP) Resource Document for Shipyards Paperback – 1995
3. Handbook on Employment Management in the Shipyard: Dealing with Modern Methods and Practices of Employment Management. Special Bulletin. Labor Loss
4. Ruben Kretzschmar- Best Management Practices for Oregon Shipyards

REFERENCE BOOKS:

1. http://www.ibc-asia.com/training/maritime/shipyard-management-design-planning- operations/overview
2. http://www.dnvusa.com/services/training/industries/maritime/technical_competence/shipyard_operations_management.asp

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA503	Fundamentals of Offshore Structures	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester V)		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. To provide the basic knowledge on different offshore structures. 2. To understand the loads acting on offshore structure and mooring lines 3. To understand the different installation methods taken in offshore field
Course Outcome	After completion of the course, the students will be able to: 1. To design the different types of offshore structures 2. To value the different materials used in offshore construction 3. To examine the type of loads taken place on structure and mooring lines 4. To demonstrate the different mooring equipment 5. To describe the type of installation methods taken place in offshore industry. 6. To list the materials, loading and installation of offshore structure

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	2	1	2	-	1	2	2	2	1	1	2	2
CO4	3	3	3	1	1	2	1	2	2	3	3	1	2	2	2
CO5	3	3	2	1	1	2	2	2	1	3	3	1	2	3	3
CO6	3	3	1	1	1	1	1	2	1	2	3	1	1	1	3
AVERAGE	2.50	2.50	2.00	1.25	1.00	1.75	1.33	1.50	1.33	2.33	2.50	1.00	1.33	2.00	2.33

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

UNIT 1: Introduction to Offshore Structures **9 Hrs**

Introduction – Deepwater challenges – Functions of Offshore Structures – Offshore Structure Configurations – Bottom – Supported Fixed Structures – Complaint Structures – Floating Structures.

UNITII: Offshore Material and Construction **9 Hrs**

Introduction – Structural Steel – Topside Materials – Advanced Composite materials – Corrosion Control – Material Reliability and Monitoring – Fracture Control

UNIT III: Offshore Loads and Response **9 Hrs**

Introduction – Gravity Loads – Hydrostatic Loads – Resistance Loads – Current loads on Structures – Current Drag and Lift Force – Steady and Dynamic Wind Loads on Structures – Wave Loads on Structures — Introduction to design.

UNIT IV: Mooring system and Topside layout facilities **9Hrs**

Introduction — Mooring Hardware components – Industry Standards and Classification Rules
Introduction – General layout Considerations – Areas and Equipment – Deck Impact Loads
– Deck Placement and Configuration – Float over Deck Installation – Helideck – Platform Crane

UNIT V: Offshore Installation **9 Hrs**

Regulations and codes of practice. Topsides and General layout Considerations of offshore platforms. Foundation

systems for offshore structures, Towing, launching and installation of offshore structures and pipe lines.Fixed Platform Substructures – Floating Structures – Foundations – Subsea Templates – Platform Installation Methods.

TOTAL HOURS: 45

TEXT BOOKS

1. Subrata K Ckakrabarti., Handbook of Offshore Engineering Vol 1
2. Subrata K Ckakrabarti., Handbook of Offshore Engineering Vol 2

REFERENCE BOOKS:

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

Designed by	"Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA5PA	Ship Design Calculation Drawing & Drafting III SDCADD-III	L	T	P	C
		0	0	4	2

Year and Semester	III Year (semester V)		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. Understand the structural design & calculation of ship hull 2 Understand the response of ship structural elements 3 Understand the types of failures in ship
Course Outcome	After completion of the course, the students will be able to: 1. To develop the structural design & calculation of ship hull 2. To weigh the longitudinal ship strength 3. To examine the structural elements under bending and buckling 4. To interpret the failures in ships 5. To discuss arrangement of structural elements 6. To list the ship design calculation

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	1	-	-	1	1	2	2	1	1	2
CO2	2	2	2	2	-	1	-	-	1	1	2	2	1	1	2
CO3	2	2	2	2	1	1	-	2	1	2	2	2	1	1	2
CO4	2	2	3	2	1	2	1	2	3	3	3	2	1	1	2
CO5	2	3	3	2	2	2	1	1	2	3	3	3	2	2	1
CO6	3	3	3	2	2	2	2	1	2	2	3	3	2	2	1
AVERAGE	2.17	2.33	2.50	2.00	1.50	1.50	1.33	1.50	1.67	2.00	2.50	2.33	1.33	1.33	1.67

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

LIST OF EXPERIMENTS

1. Ship in calm water, wave bending, stresses due to bending
2. Types of stiffeners, girders & various strengthening members.
3. Plates under bending forces, plates under buckling, types of failures, shell expansion plan
4. Leakage, collapse, fatigue, bending, bending and bucking of beams,
5. Equivalent width of bending plates, weight curve, buoyancy curve, shear force & bending moment diagram
6. Types of bulkheads, watertight bulkhead design & drawing, arrangement of watertight & non-watertight bulkhead penetration

TOTAL HOURS 60

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"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA5PB	SOFTWARE LABORATORY– AVEAVA MARINE- TRIBON-II	L	T	P	C
		0	0	4	2

Year and Semester	III Year (semester V)		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. Understand the design software AVEVA MARINE 2. Understand the initial design of ship using software 3. Understand the hydrostatic and hydrodynamics calculations
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the software fully for ship design 2. To select the primitive building blocks of software design 3. To examine the hydrostatic and hydrodynamic calculations 4. To implement the draft and modelling techniques 5. To classify the hull structural design 6. To repeat the software steps without the help of instructors

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	2	1	1	2	1	2	2	2	1	1	2	2
CO4	2	2	3	2	2	1	2	2	3	3	2	1	1	3	2
CO5	3	2	3	2	2	1	2	3	3	3	3	2	2	3	3
CO6	3	3	3	2	2	1	2	2	3	2	3	2	2	3	3
AVERAGE	2.33	2.17	2.50	2.00	1.50	1.00	2.00	1.67	2.17	2.33	2.33	1.33	1.33	2.50	2.33

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

LIST OF EXPERIMENTS

1. Introduction - Creating of New Project - Creating of New Database, SURFACE – Introduction-Basic Tool Bars Primitives- Creating and Manipulating 2D Primitives –Blending- Outputs-Offset Table, COMPARTMENT- Introduction Basics of Compartment

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

3. Hydrostatic- Introduction Basics- Performing Fundamental Calculations- Running More Complicated Calculations. Hydrodynamics- Introduction Basics – Powering Calculations- Maneuvering Calculations- Sea keeping Calculations- Dynamic Positioning Calculations.

4. HULL DRAFTING- Introduction- Getting Started- Viewing the Ship Model- Basic Geometry- Dimensioning. HULL STRUCTURAL DESIGN- Introduction- Initialization,

5. Curved Hull Modeling- Reference Surface Design (RSO)- Displaying Compartments- Functional Structures- Curved Surfaces- Design Utilities- Block Division.

6. PLANAR HULL MODELING - Planar Hull Modelling Concept- Getting Started- Seams- Plates- Excess- Weld Tap

Pieces- Panel Specific Curves & Topological points- Stiffeners- Flanges- Notches- Cut outs Holes & Doubling Plate- Brackets- Position Number. **TOTAL: 60 HOURS**
TEXT BOOKS 1. AVEVA MARINE MANUALS **REFERENCE BOOKS:** 2. AVEVA MARINE TRAINING MANUALS
Designed by "Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA5PC	SEAMANSHIP LAB	L	T	P	C
		0	0	2	1

Year and Semester	III Year (semester V)		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. To understand the equipment's on board ship 2. To know basic communication system 3. To understand the electrical equipment and power distribution
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the various deck equipment 2. To select the equipment for various operations 3. To examine the conditions of deck, engine and electrical equipment 4. To implement the different maintenance schedule 5. To classify the equipment based on operation 6. To repeat the functional aspects of equipment on board

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO4	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO5	2	2	2	1	1	-	-	1	2	2	2	1	1	2	2
CO6	2	2	1	1	1	-	-	1	2	2	2	1	1	2	2
AVERAGE	2	2	1.8	0.3	1	-	-	1	1.7	2	2	1	1	2	2

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

LIST OF EXPERIMENTS

1. Various Decks. All the equipment fitted on the deck (like windlass, capstan, winches, cranes, bitts Bollard etc. Engine room (the main engine and auxiliary engine, compressors, feed pumps, fuel oil pumps, exhaust system, and other accessories)
2. Location of various tanks and their usage. Access arrangements (ladders, gang ways). Accommodation area Equipments used for anchoring and mooring (Ground tackle equipments like anchor, anchor chain, wire rope, shackles, chain shoppers) chain lockers etc.
3. Bulwark and guard rail. Communication equipments. Fendering
4. Cargo holds .Doors and hatches. Bulk heads. Wheel house. Masts, top light, range light. Steering gear compartment.
5. AC & Refrigeration equipments. Propeller shaft system. Piping and valves.
6. Electrical equipments, like generators, motors, control panel etc. After the visit the students shall submit a report for evaluation.

TOTAL HOURS: 30

Designed by	"Department of Naval Architecture & Offshore Engineering"

SEMESTER VI

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	COMPUTATIONAL MARINE HYDRODYNAMICS	L	T	P	C
UANA602		3	1	0	4

Year and Semester	III Year (semester VI)		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 computational approach in marine hydrodynamics related problems. 2. To understand the potential flow 3. To understand the hydrodynamic forces and flow modeling
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the computational approach in general 2. To value basic fundamental problems in marine hydrodynamics 3. To relate and compute Pressure and Forces from potential flow 4. To demonstrate the rigid body motion under external forces 5. To describe different flow models and modelling 6. To define computational skill by solving the benchmark fluid mechanic case study

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO4	3	3	2	-	1	1	1	1	2	2	2	1	2	3	3
CO5	3	3	3	2	2	1	1	2	3	3	3	2	2	3	3
CO6	2	2	2	1	1	2	1	1	2	3	3	2	1	2	3
AVERAGE	2.33	2.33	2.17	1.50	1.17	1.33	1.00	1.17	1.83	2.33	2.33	1.33	1.33	2.33	2.50

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

UNIT 1: Concept of numerical approach **12 Hrs**

Introduction to numerical methods: interpolation, differentiation, integration, systems of linear equations.

UNIT II: CFD concept **12 Hrs**

Fluid Dynamics fundamentals. Solution of differential equations by numerical integration. Introduction to CFD concepts. Concept of Finite difference method and Finite volume method.

UNIT III: Potential flow and theory **12 Hrs**

Potential flow and its applications, Potential flow theory. Two-Dimensional Panel Methods, Numerical Form of the Two-Dimensional Integral Equation, Situations with the Generation of Lift, Computation of Pressures and Forces.

UNIT IV: Hydrodynamic forces **12 Hrs**

External forces acting on a body. Rigid body motions, Strip theory and numerical solution.

UNIT V: Viscous flow model and effects **12 Hrs**

Viscous flow model, Boundary layer and modelling approach. RANS based models. Application of CFD in maritime sector, Understanding ship resistance simulation in CFD

TOTAL: 60 HOURS

TEXT BOOKS

1. J. D. Anderson. CFD: The basics with applications, ed 6, 1995.
2. H. K. Versteeg and W Malalasekera: An introduction to CFD – The Finite volume method.
3. P. Knupp and S. Steinberg. Fundamentals of grid generation, CRC press 1994.
4. Joseph Kartz & Allen Plotkin, Low-speed Aerodynamics, Edition 2nd, Cambridge University press, 2001

REFERENCE BOOKS:

1. T. J. Chung, Computational Fluid Dynamics, Edition 2nd, Cambridge University, 2014
2. Volker Bertram, Practical Ship Hydrodynamics, Edition 2nd, Butterworth-Heinemann, 2012

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA603	STRUCTURAL DESIGN OF SHIPS	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester VI)	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. To know the principal layout of a hull structure and the function of the different structure elements. 2 To understand the loads a ship structure is subjected to and how these loads are predicted in design. 3. To understand the structural and loading system in ship
Course Outcome	After completion of the course, the students will be able to: 1. Do the design of a ship according to class rules based on rule requirements and direct calculations 2. To value the estimation of the hull structure weight, 3. To examine the challenges in design of ships and other complex structures. 4. To execute the scantling calculations 5. To explain the load calculations in cargo handling system 6. To define the material and structure of ship

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	3	-	1	-	-	1	2	2	2	1	1	2	2
CO4	3	3	3	2	2	-	1	1	2	2	2	1	1	2	2
CO5	2	2	2	1	2	2	1	2	2	3	3	2	2	3	3
CO6	3	3	2	1	2	2	2	2	2	3	3	2	2	3	3
AVERAGE	2.33	2.33	2.33	1.33	1.5	2.0	1.33	1.33	1.67	2.33	2.33	1.33	1.33	2.33	2.33

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

UNIT I: Ship building material and Joining techniques **9 Hrs**

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

UNIT II: Ship Design Concepts and Rules **9 Hrs**

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

UNIT III: Ship Structural Systems **9 Hrs**

Ship structural systems, Ship as stiffened plate structure – framing systems, common stiffeners sections corrugated constructions, design of strakes (butt & seams), welding sequence, shell expansion

Structural subsystems – bottom structure, side shell structure, deck structure, bulkhead structure, super structure etc.

General structural arrangements of different type of ships (historical review), sub- assembly, stiffened panels

and volume sections.

UNIT I V: Structural Scantling **9 Hrs**

Type, functions, framing systems, components & scantlings, structural connections of components: -
Bottom structure (Double & single bottom, openings, bilge keel), side structure, deck structure (hatchways, pillars, bulwarks, guardrails, fenders) bulkhead structure fore & aft end structure, panting & pounding arrangement, compatibility of bottom and side, side and deck, deck and bulkhead, side and bottom, engine room (engine foundation, casing, structural design) super structure, deck house (effectiveness, structural design, openings, expansion joints etc.

UNIT V: Cargo handling system **9 Hrs**

Cargo handling equipment – different systems, mast derrick system, loads calculations on mast derrick system, design of mast derrick system, deck cranes.
Base Twistlock, Semi Automatic Twistlock, Midlocks, Hanging staker, Lashing rods, Turnbuckle and Bottle Screw
Hatch covers – functions, load, statutory requirements, types, cleating and sealing arrangements, pontoon covers design.
Construction of lifeboats, submarine structure, chain locker hawse pipe, rudder types and their construction.Nozzles, stern tube and bossing.

Total: 45 Hours

TEXT BOOKS:

1. Taggart: Ship Design and construction SNAME
2. Okumoto, Y., Takeda, Y., Mano, M., Okada, T.: Design of Ship Hull Structures, A Practical Guide for Engineers, (2009)
3. S.C Mishra: Design principles of Ships and marine structures, CRC Press, 2015

REFERENCES BOOKS

1. Rosén, A., Hull structure design, KTH Centre for Naval Architecture, 2007.
2. D 'Arcangelo: Ship Design and construction, SNAME.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	STRUCTURAL DESIGN OF	L	T	P	C
UANA604	OFFSHORE STRUCTURES	3	0	0	3

Year and Semester	III Year (semester VI)		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. Effective designing of offshore structures compiles with standards and regulations. 2. Designing of Plates beams and Tubular members. 3. Detailed Pile design.
Course Outcome	After completion of the course, the students will be able to: 1. To estimate the load on offshore structures 2. To design and evaluate steel member design 3. To analyze the design based on combined loads 4. Punching shear and joint capacity including fatigue analysis can be done by students 5. Pile design, plates and beams including tubular joints are derivate. 6. Efficiently plan and Successfully design an offshore platform

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	1	-	1	2	2	2	1	1	2	2
CO4	2	2	2	2	1	2	2	2	2	3	2	1	1	2	2
CO5	3	3	2	1	1	2	1	2	3	3	3	2	2	3	3
CO6	3	3	1	1	1	1	2	1	3	2	3	2	2	3	3
AVERAGE	2.33	2.33	1.83	1.33	1	1.5	1.67	1.33	1.7	2.33	2.33	1.33	1.33	2.33	2.33

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

UNIT 1: Planning and Load estimation **9 Hrs**

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

UNIT II: Design of steel Members **9 Hrs**

Design of tension and compression members, plates and beams.

UNIT III: Design of Offshore Steel Structures **9 Hrs**

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

UNIT IV: Design of Tubular joints. **9 Hrs**

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

UNIT V: Pile Foundation and Design **9 Hrs**

Load carrying capacity of piles, Pile group, Lateral resistance of piles, Settlement of piles

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

TOTAL HOURS : 45

TEXT BOOKS

1. Hand book of Offshore Engineering – S.K. Chakrabarti, Elsevier Publications 2005.

2. Offshore Structural Engineering – Dawson T.H. Printice Hall, 1983.

REFERENCE BOOKS:

1. API RP 2A WSD 1993
2. API RP 2A LRFD 2000
3. DNV Offshore standards and Regulations

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA605	Sea Keeping and Controllability of Ships	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester VI)	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. To understand the wave motion and hydrodynamics 2. To understand the dynamics of ship motion 3. To understand the sea keeping performance
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the hydrodynamic forces 2. To weigh the different ship motion in waves 3. To compare the use of different stabilizing unit 4. To interpret the sea keeping performance 5. To explain the floating system dynamics 6. To define the controllability of ship

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	1	1	-	2	1	2	2	2	1	1	2	2
CO4	2	3	3	1	2	2	1	1	3	2	3	2	1	2	3
CO5	3	3	3	2	2	1	1	2	3	3	3	2	2	3	3
CO6	3	3	2	2	2	1	1	2	2	3	2	2	2	3	3
AVERAGE	2.33	2.50	2.33	1.50	1.50	1.33	1.25	1.33	2.00	2.33	2.33	1.50	1.33	2.33	2.50

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

Unit I: INTRODUCTION **9 Hrs**

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

Unit II: SHIP IN A SEAWAY **9 Hrs**

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

Unit III: SHIP MOTIONS **9 Hrs**

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

Unit IV: SEAKEEPING DESINGN CONCEPTS **9 Hrs**

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

UNIT V: MANEUVERING CHARACTERISTICS OF SURFACE SHIP **9 Hrs**

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

Total: 45 Hours

TEXT BOOKS

1. Bhattacharya.R; "Dynamics of Marine Vehicles" 1978, Wiley Inter Science,Newyark.

REFERENCE BOOKS

3. Lewis E.U; "Principles of Naval Architecture" (2nd Rev) Vol. III**,** 1989, SNAME Newyark.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	ADVANCED OFFSHORE ENGINEERING	L	T	P	C
UANA606		3	0	0	3

Year and Semester	III Year (semester VI)		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. To understand offshore drilling/production challenges. 2. To learn basics of Mooring and Marine Riser systems. 3. To understand Deep water support vessel like ROV/AUV and its working
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the deep-water challenges to be face and to find its remedies. 2. To judge the dynamic behavior of riser system 3. To compare basic Mooring and Riser requirements and analysis. 4. To solve the vibration and fatigue behavior of offshore structures 5. To identify the design and working of remotely operated vehicles 6. To define the dynamic behavior and deep-water challenges of offshore structures

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	2	-	-	1	1	2	2	1	1	2	3
CO3	2	2	3	-	1	-	-	1	2	2	2	1	1	2	2
CO4	2	2	3	-	1	1	1	1	2	2	2	1	2	3	2
CO5	3	3	2	1	2	1	2	2	2	2	2	1	2	3	3
CO6	2	2	1	1	1	1	2	1	2	2	2	1	1	2	2
AVERAGE	2.17	2.17	2.17	1.00	1.33	1.00	1.67	1.17	1.67	2.00	2.00	1.00	1.33	2.33	2.33
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1: OIL AND GAS FIELD DEVELOPMENT **9 Hrs**

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

UNIT II: RISER SYSTEMS **9 Hrs**

Riser systems: Marine riser systems, typical configurations, top tensioned vertical risers, hybrid risers, flexible pipe structure and material. Riser analysis: governing equations, boundary conditions, natural frequency

UNIT III: MOORING LINES **9 Hrs**

Mooring lines: typical mooring configuration, material and construction, anchors and ancillary equipment, static mooring analysis.

UNIT IV: FLOW ASSURANCE AND VORTEX INDUCED VIBRATION **9 Hrs**

Flow assurance: multi-phase flow, deposition of solids, thermal management, corrosion. Vortex induced vibration: drag, vortex shedding, surface roughness, lift, Strouhal number, VIV assessment, fatigue life calculation.

UNIT V: UNDERWATER VEHICLES **9 Hrs**

Remotely operated vehicles (ROVs): Applications and various design concept, ROV handling systems, construction and materials, navigation and control.

Autonomous underwater vehicle: Applications and design concept, material selection, construction, various sensors and control system. Case study: design of anyone underwater vehicle.

TOTAL: 45 HOURS

TEXT BOOKS

1. N Barltrop, Floating structures: A Guide for design and analysis, OPL, 1998.
2. BC Grewick, Jr. Construction of marine and offshore structure, CRC Press, 2000.
3. RD Blevins, Flow induced vibrations, Van Nostrand Reinhold, 1990.
4. EE Allimendinger, Submersible vehicle systems design. SNAME, 1990.
5. HO Bordeaux, Buoy engineering, John Wiley, 1975.

REFERENCE BOOKS:

1. ABS , DNV codes.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	FOUNDATION OF OFFSHORE	L	T	P	C
UANA607	STRUCTURES	3	0	0	3

Year and Semester	III Year (semester VI)		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. To understand the basic soil mechanics 2. To understand the foundations of offshore structures 3. To understand the installation and loading of Pile
Course Outcome	After completion of the course, the students will be able to: 1. To formulate appropriate drilling, sampling and field property measurement tools for different soil profiles. 2. To judge necessary laboratory tests to understand the site-specific behavior of foundations 3. To organize laboratory and field data to select appropriate shear strength values to use in foundation analysis 4. To interpret the design and Analysis of Shallow Foundations: 5. To identify the design and Analysis of Deep Foundations 6. To repeat the characteristics of special foundations

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	1	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	1	1	2	-	1	3	2	2	1	1	2	2
CO4	3	2	3	-	1	1	2	1	2	3	2	1	2	3	2
CO5	3	3	3	1	2	1	1	2	3	3	3	2	2	3	3
CO6	2	3	2	1	2	1	1	2	2	2	3	2	1	3	3
AVERAGE	2.50	2.33	2.33	1.00	1.33	1.25	1.33	1.33	2.00	2.33	2.33	1.33	1.33	2.50	2.33
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

UNIT I: Basic Soil Mechanics **9 Hrs**

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: Types of foundations and Pile design **9Hrs**

Foundation types-foundation design requirements. Shallow foundations, 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, Pile group stiffness and structure dynamics , scour around piles, seabed subsidence and design of piles against seabed movement, negative skin friction, cyclic degradation, main pile to jacket connections, skirt pile to jacket connections, API RP 2A provisions.

UNIT III: Pile Installation **9 Hrs**

Pile Installation: Pile wall thickness, Allowable pile stress, Design pile stresses, Stresses during pile driving stresses, static and dynamic stresses, pile stickup, stresses during stickup, wave and current loads, hammer selection, pile driving stresses, wave equation analysis, Fatigue damage calculation n while pile driving, API RP 2A guidelines.

UNIT IV: Pile load testing **9 Hrs**

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

UNIT V: Special Foundations **9 Hrs**

Footing subjected to moments, tension, introduction to Piled Raft foundation

Mud-mats: bearing capacity, sliding stability, overturning stability, short term and long-term settlements, factor of safety; 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

REFERENCE BOOKS:

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"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	PIPING ENGINEERING	L	T	P	C
UANA608		3	0	0	3

Year and Semester	III Year (semester VI)		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. Basic understanding of Piping lay out, preparation and installation methods. 2. Basic understanding of Stress analysis of pipeline
Course Outcome	After completion of the course, the students will be able to: 1. To develop of piping lay out drawings, piping isometric drawings 2. To judge processes and issues involved with designing and construction 3. To examine piping design independently 4. To execute submarine piping plan 5. To identify subsea piping system 6. To define the pumping and piping system onboard

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	2	1	-	-	1	2	2	2	1	1	2	2
CO4	3	3	2	2	1	2	2	1	2	2	2	1	1	2	2
CO5	3	3	3	1	2	1	2	2	2	3	3	2	2	3	3
CO6	3	2	1	1	2	1	2	1	3	3	3	2	1	2	2
AVERAGE	2.50	2.33	2.00	1.50	1.33	1.33	2.00	1.17	1.83	2.33	2.33	1.33	1.17	2.17	2.17

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

UNIT – I Introduction to Piping. **9 Hrs**

Introduction –Pipe, classification of pipelines, Piping basic, Piping shape, Piping materials, Selection of thickness and Diameter, Piping flexibility, Piping components & types, Selection of code & standards.

Pipeline design codes (API, ASME, ASTM, etc). Plans to be submitted for piping arrangements for classification society approval.

UNIT – II Piping Design **9 Hrs**

P&ID, PFD, Commonly used Graphical symbols in representing pipelines and piping diagrams, Color Coding for piping systems for intended services. Isometric preparation , Pipeline thickness calculation ,stress analysis valve selection , Instruments , MTO preparation ,Quality assurance and quality control plan ,Station piping , Cross country piping. Installation – welding , NDT methods. Coating methods, insulation , leak tests on piping systems, pipe standards / Repair standards. Types of valves, Steam piping, temperature of pipes in hazardous areas and other specialized operations

UNIT – III Piping and Pumping arrangements in ships: **9 Hrs**

General Pumping arrangements and associated pipe fittings of piping arrangements with respect to carrying contents, pump capacity and location. Bilge suction, Tank suction, Filling,

Air pipes, sounding and overflow, Bilge system, water ballast systems, oil fuel systems, feed systems, Scupper arrangements for draining, Closing arrangements for air pipes and ventilation pipes.

UNIT – IV Submarine pipeline **9 Hrs**

Submarine pipeline- Design, stability analysis, Pipe routing plan, Pipe passing through watertight penetrations, gas tight glands,

corrosion and methods to resist corrosion in pipeline. Different type of offshore pipe lying methods.

UNIT – V Riser and subsea systems **9 Hrs**

Drilling risers, production risers: flexible, steel catenary; flexible riser configurations: steep/lazy S and wave, free-hanging; flexible riser components; rigid riser components, Riser – Design, Pipes and piping arrangements for offshore services-Fixed drilling / production platforms, Gas and oil production systems, Submersible units and systems, Oil and gas fired unit‘s locations

Total: 45 Hours

TEXT BOOKS

1. George A. Antaki Piping and Pipeline Engineering: Design, Construction, Maintenance, Integrity, and Repair
2. M L Nayyar, Piping handbook
3. Boyun Guo, Shanhong Song, Jacob Chacko,Ali Ghalambor, Offshore Pipelines
4. Eric Murdoch, A Master ‘s guide to ship piping
5. Shashi Menon, Piping Calculations Manual (McGraw-Hill Calculations)– December 10, 2004

REFERENCE BOOKS:

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 UANA609	ELEMENTS OF GEO - TECHNICAL ENGINEERING	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester VI)		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. To know behavior of marine soil. 2. Classify and characterize soils for foundation design. 3. To understand the stability of offshore structures under cyclic loading
Course Outcome	After completion of the course, the students will be able to: 1 To develop suitable collecting, sampling and field property measurement tools for different soil. 2 To weigh necessary laboratory tests to understand the site-specific behavior of foundations 3 To relate laboratory and field data to select appropriate shear strength values to use in foundation analysis 4 To implement the capacity of foundations. 5 To discuss the settlement of the soil under the foundation load. 6 To define the stability of offshore platforms

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	1	1	-	-	1	2	2	2	1	1	2	2
CO4	2	2	2	1	1	1	1	2	2	3	2	1	1	3	3
CO5	3	3	2	1	1	1	1	1	3	3	2	2	1	3	2
CO6	3	1	2	1	2	1	1	2	3	3	2	2	1	3	3
AVERAGE	2.33	2.00	2.00	1.00	1.17	1.00	1.00	1.33	2.00	2.50	2.00	1.33	1.00	2.50	2.33

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

UNIT 1: Basic of Marine soil **9 Hrs**

Introduction to Marine Geotechnical Engineering: Scope of marine geotechnical engineering - Marine and submarine soils - Classification of marine soils - Relative distribution of marine soils in the different marine regions - General characteristics of marine deposits in some specific locations and in the Indian sub-continent.

Sediment logical characteristics of marine soils: Structure of marine soils - Cementation bonding - Morphology and genesis of marine and submarine sediments - Post-depositional changes - Effect of calcium carbonate in marine deposits.

UNIT II : Engineering Properties of soil **9 Hrs**

Engineering behaviour of marine soils: Fine and coarse-grained deposits - Strength and deformation behaviour of fine - and coarse-grained marine deposits - Effect of cementation - Strength and deformation behaviour under static and cyclic loading.

UNIT III : Offshore soil investigation techniques **9 Hrs**

Offshore Soil Investigation: General characteristics of offshore soil exploration - Sampling using free corer, gravity corer, tethered systems and manned submersibles - Deep penetration sampling using wire line techniques - In-situ determination of strength of submarine soils - Penetrometer, piezocone, vane and pressure meter techniques - General reconnaissance procedure for installation of fixed structures (gravity and piled type), floating structures, sea bed anchors and submarine pipelines.

UNIT IV : Foundation of offshore structures **9 Hrs**

Foundations for Gravity Structures: Types of gravity structures - Installation techniques - Movement of gravity structures - Settlement of soil beneath gravity structures - Stress distribution beneath gravity structures - Stability of gravity structures under static and cyclic loads

Foundations for jacket type structures: Types - Installation techniques - Design considerations - Axial and lateral load capacity of piles - Lateral load deformation behaviour of piles - Calculation of bearing capacity of piles - Design of piles subjected to lateral loads Reese-Matlock method & p-y curves method.

UNIT V : Foundation of advanced offshore structures **9 Hrs**

Foundation modeling, structural modeling.

Piles and mat supported - Spud cans - Different types - Techniques for installation and removal of jack up - Stability of jack up platforms - Determination of penetration of supports - Stability under lateral loads - Stability under static and cyclic load effects. Sea bed anchors.

Total: 45 Hours

TEXT BOOKS

1. Gopal Ranjan, A S R R a o - Basic and Applied Soil Mechanics New Age International, 1 Jan 2007
2. Chaney, F. Marine geotechnology and nearshore/offshore structures, ASTM, STP-, 1986.
3. Chaney, R. C &Demars, K. R., Strength Testing of Marine Sediments - Laboratory and In-situ
4. Measurements, ASTM, STP -883, 1985.
5. George, P & Wood, D., Offshore Soil Mechanics, Cambridge University Press.

REFERENCE BOOKS

1. Le Tirant, Sea Bed Reconnaissance and Offshore Soil Mechanics for the Installation of Petroleum tructures, Gulf Publ. Co., 1979.
2. Poulos, H. G & Davis, E. H., Pile Foundation Analysis and Design, John Wiley, 1980.
3. Numerical Methods in offshore Piling, Proc. Conf. Inst. of Civil Engineers, London, 1980.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	QUALITY HEALTH SAFETY AND	L	T	P	C
UANA610	ENVIRONMENTAL MANAGEMENT	3	0	0	3

Year and Semester	III Year (semester VI)		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. To understand the quality control and quality assurance concepts 2. To understand the safety health and environment management 3. To understand the safety in design and process operations
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the quality awareness programs 2. To judge the safety assurance and assessment 3. To compare the environmental impact of decommission 4. To interpret the accidents modelling 5. To discuss case studies in safety management 6. To repeat the safety concepts in process management

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	1	1	-	1	1	2	2	2	1	1	2	2
CO4	2	2	2	1	2	1	1	2	2	3	3	3	2	2	3
CO5	2	3	3	2	2	1	2	2	3	3	3	2	2	3	3
CO6	2	3	2	2	2	1	2	2	3	3	2	2	2	3	3
AVERAGE	2.00	2.33	2.17	1.50	1.50	1.00	1.50	1.50	2.00	2.50	2.33	1.67	1.50	2.33	2.50

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

Unit I: Introduction **9 Hrs**

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. 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 II: Safety, Health and Environmental Management **9 Hrs**

Introduction to safety, health and environmental management. Basic terms and their definitions. Importance of safety in petroleum and offshore industry. Safety assurance and assessment. Safety in design and operation. Organizing for safety. Hazard classification and assessment. Hazard evaluation and hazard control

Unit III: Environmental issues and Management **9 Hrs**

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

Unit IV: Environmental management **9 Hrs**

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

Unit V: Safety Measures **9 Hrs**

Safety management concept in ships and ports and ISO certifications.

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

TOTAL: 45 HOURS

REFERENCES:

1. Skelton, B. (1997). Process safety analysis, Gulf Publishing Company, Houston, 210pp.
2. Jan Erik Vinnem (2007). *Offshore Risk Assessment: Principles, Modeling and Applications of QRA studies.* Springer, 577pp.
3. Terje Aven and Jan Erik Vinnem. (2007). *Risk Management with applications from Offshore Petroleum Industry.* Springer, 200pp.
4. Jorg Schneider. (1997*). Introduction to Safety and Reliability of Structures.* Structural Engineering Documents Vol. 5, International Association for Bridge and Structural Engineering (IABSE), 138pp.
5. *Lees, F.P. (1996). Loss Prevention in Process Industries: Hazard identification, Assessment and Control, Vol*. 1-3, Butterwort-Heinemann, Oxford, 1245pp.
6. Patin, Stanislav. (1999). *Environmental Impact of the Offshore Oil and Gas Industry.* Eco Monitor Publishing, USA, 425pp.

William J. Cairns (Ed), 1992. *North Sea Oil and the Environment: Development Oil and Gas Resources, Environmental Impacts and Responses*, International Council of Oil and the Environment

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA611	Work Force Management in Industry	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester VI)		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. Understand the industrial organization structure 2. Understand the human psychology 3. Understand the workforce management
Course Outcome	After completion of the course, the students will be able to: 1. To investigate the organizational structure 2. To value the role of managers and supervisors 3. To compare the perceptions of workforce relationship management 4. To implement the theory of motivation 5. To discuss labor budgeting 6. To define the workforce management in industry

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	1	1	1	1	1	2	2	2	1	1	2	2
CO4	2	3	2	1	2	1	1	2	2	3	2	1	1	2	2
CO5	3	3	2	2	2	2	1	2	3	3	3	2	2	3	3
CO6	3	3	2	2	2	2	2	2	3	3	3	2	2	3	3
AVERAGE	2.33	2.50	2.00	1.50	1.50	1.50	1.25	1.50	2.00	2.50	2.33	1.33	1.33	2.33	2.33

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

Unit I Defining a Work force **9 Hrs**

Typical Industrial Organisation structure; function and responsibilities of each department/sections. Role of HRM department – Work Force Administration - Payroll and benefits; Time and attendance; Discipline; Work Force Welfare

Unit II Role of Supervisors **9 Hrs**

Line Managers and Middle level Managers in Work Force Management Essential Managerial Qualities and Traits. Evaluation and Assessment of Work force Performance management; Performance Appraisal

Unit III Human Psychology **9 Hrs**

Perceptions in different level of Work force Relationship Management; People skills. Talent management -Developing the work force talent; Learning management and/or training management.

Unit IV Motivating Work force **9 Hrs**

Theory of Motivation; Case Studies Career and succession planning / talent acquisition Management of Contractors and his work force Management

Unit V Workforce Management **9 Hrs**

Reducing socio-environmental costs and risks: managing the downside, Social and environmental risk/liability management, Forecasting and scheduling Labour budgeting. Workforce tracking and emergency assist Absence and leave management Adherence / conformance to schedule

Total: 45 Hours

TEXT BOOKS

1. Layman's Guide to Workforce Management: A Guide to Workforce Optimization and Life-cycle

REFERENCE BOOKS

1. Workforce Asset Management Book of Knowledge

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA6PA	SHIP DESIGN CALCULATION DRAWING & DRAFTING – IV SDCADD-IV	L	T	P	C
		0	0	4	2

Year and Semester	III Year (semester VI)		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 study & perform hydrodynamic calculations in ship 2. To study various types of outfitting equipment's & the corresponding arrangements
Course Outcome	After completion of the course, the students will be able to: 1. To develop the resistance calculations of ship 2. To select the theory of propeller action 3. To examine the powering calculation 4. To solve the hull vibration problem 5. To describe the sea keeping calculation 6. To list the arrangement of accesses opening

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	1	1	1	2	1	2	2	2	1	1	2	2
CO4	2	3	3	1	2	1	2	2	3	3	2	2	1	2	3
CO5	3	3	3	2	2	1	1	2	3	2	1	2	2	3	3
CO6	3	2	3	2	2	1	1	2	2	1	1	2	2	3	3
AVERAGE	2.33	2.33	2.50	1.50	1.50	1.00	1.50	1.50	2.00	2.00	1.67	1.50	1.33	2.33	2.50

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

LIST OF EXPERIMENTS

1. Types of resistance, dimentional analysis, resistance and power curves, calculation of ship resistance & power estimation, extension of model results to ship.
2. Methods of presenting model resistance data, relation of hull form to resistance.
3. Powering of ships, theory of propeller action, design of propellers and propeller drawings, shaft line drawing,
4. Dimensional analysis, interaction between hull & propeller, propulsion tests, obtaining results from tests.
5. Sea keeping calculation, types of rudders, design of rudder & drawings, hull vibrations.
6. Arrangement of cargo holds, engine room, tanks, accommodation area, and out fittings, Door plan, Design & drawing of various types of doors and hatches.

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"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	SOFTWARE LABORATORY– DNV	L	T	P	C
UANA6PB	SESAM	0	0	2	1

Year and Semester	III Year (semester VI)		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.Understand the design software SESAM 2.Understand the design of offshore structures using software
Course Outcome	After completion of the course, the students will be able to: 1. To develop the offshore structure using the software 2. To select the sections and materials in software 3. To create the jacket leg structure 4. To implement the load case analysis 5. To discuss the environmental modelling 6. To state the use of software without the help of instructors

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	1	1	-	1	1	2	2	2	1	1	2	2
CO4	3	3	3	1	1	1	1	2	2	3	3	2	2	3	3
CO5	3	3	3	2	2	1	2	2	3	3	3	2	2	3	3
CO6	2	2	1	2	2	2	2	2	3	3	2	2	3	2	2
AVERAGE	2.33	2.33	2.17	1.50	1.33	1.33	1.50	1.50	2.00	2.50	2.33	1.50	1.67	2.33	2.33

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

LIST OF EXPERIMENTS

1. Introduction to Sesam Jacket Structure modelling
2. Creating Sections and Materials
3. Creating Jacket legs Creating Topside structure
4. Joints modeling Load case analysis
5. Environmental modeling Soil
6. Pile modeling Pile soil interaction

TOTAL HOURS: 30

TEXT BOOKS

1. DNV SESAM MANUALS

REFERENCE BOOKS:

2. DNV SESAM TRAINING MANUALS

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA6PC	MINOR PROJECT	L	T	P	C
		0	0	3	2

Year and Semester	III Year (semester VI)		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	To carry out a minor project in naval architecture and offshore engineering			
Course Outcome	After completion of the course, the students will be able to: 1. Describe the components on a ship design project 2. Estimate the basic dimensions 3. Sketch lines plan and general arrangement for the given vessel 4. Predict the sea route of operation 5. Perform the basic design 6. Evaluate the design parameter			

POS/COS	PO1	PO 2	PO3	PO 4	PO5	PO 6	PO7	PO 8	PO9	PO 10	PO1 1	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	2	1	1	1	1	1	2	2	1	2	3	3
CO2	3	3	3	2	1	1	1	1	1	2	2	1	3	3	3
CO3	3	3	3	2	1	1	1	1	2	2	2	1	3	3	3
CO4	3	3	3	2	1	1	1	1	2	2	2	1	3	3	3
CO5	2	2	2	1	1	1	1	1	2	2	2	1	2	2	2
CO6	2	2	1	1	1	1	1	1	2	2	2	1	2	2	2
Average	2.7	2.7	2.5	1.7	1	1	1	1	1.7	2	2	1	2.5	2.7	2.7

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

The students will be allotted anyone-ship/offshore engineering project for the design work and they will complete the Project in Semester-VII by doing design calculations and drawings and submit the Project Report for evaluation.

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"

SEMESTER VII

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA702	Dynamics of Offshore Structures	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 explain the basic principles in hydrodynamics, dynamics, and structural mechanics in the design of ships and offshore structures. 2. To apply structural dynamic principles in the analysis of offshore structures. 3. To discuss about structural modeling
Course Outcome	After completion of the course, the students will be able to: 1. Explain the basic steps in structural dynamics. 2. Formulate a structural model and natural forces imposed by the ocean environment. 3. Practice the equations on multi degree freedom structure. 4. Practice structural dynamic analysis on offshore structure. 5. Practice dynamic analysis methodology on offshore structure on extreme wave conditions. 6. Estimate dynamic analysis of offshore structure

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	3	3	-	-	-	-	-	-	-	3	2	-
CO2	2	3	3	1	3	3	-	-	-	-	-	-	1	2	3
CO3	2	3	3	2	3	2	-	-	-	-	-	-	1	3	3
CO4	2	3	3	2	3	3	-	-	-	-	-	-	2	3	3
CO5	2	3	3	1	2	3	-	-	-	-	-	-	1	3	3
CO6	3	1	2	3	3	3	-	-	-	-	-	-	1	3	3
AVERAGE	2.4	2.5	2.8	2	2.8	2.3	-	-	-	-	-	-	1.5	2.7	2.3

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

UNIT 1: FUNDAMENTALS OF STRUCTURAL DYNAMICS **12 Hrs**

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

UNIT I1: EQUATION OF MOTION **12 Hrs**

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 **12 Hrs**

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 - Missing mass correction, Example problems - Duhamel's integrals

UNIT IV : APPLICATION OF STRUCTURAL DYNAMICS TO OFFSHORE STRUCTURES 12 Hrs

Application of structural dynamics to offshore structures. Fluid-structure interaction - Dynamic analysis of offshore jacket platforms - Dynamic analysis of articulated towers - Iterative frequency domain - Multi-legged articulated towers (MLAT) - Response control of multi-legged articulated towers using tuned mass dampers - Development of Tension Leg Platforms and geometric optimization - Dynamic analyses of TLPs - Development of Mass, stiffness and damping matrices of TLP from first principles

UNIT V: DYNAMIC ANALYSIS METHODOLOGY 12 Hrs

Motion analysis in random waves - Low frequency oscillation - High frequency oscillation - Wave drift forces - Springing forces - Non-linear sum forces - Damping at low and high frequencies - Dynamic positioning.

Total: 60 Hours

TEXT BOOKS

1. Anil K. Chopra. 2003. Dynamics of structures: Theory and applications to earthquake Engineering: Pearson Education, Singapore.
2. Arvid Naess and Torgeir MOan. 2013. Stochastic dynamics of marine structures, Cambridge University Press, New York, USA.

REFERENCE BOOKS

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 Modeling: 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"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Constructability of Offshore	L	T	P	C
UANA703	Structures	3	0	0	3

Year and Semester	IV Year (semester VII)		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. To identify various concepts involved in construction of offshore structure. 2. To identify the design concepts of various deep water offshore structures and subsea systems.. 3. To identify the Complications and methods involved in construction of Arctic marine structure.			
Course Outcome	After completion of the course, the students will be able to: 1. Apply the conceptual design of deep water structures. 2. Identify the facilities and methods for fabrication of offshore structure. 3. Outline the various phenomena in construction of deep sea structures. 4. Discuss about the methods of removal of fixed & floating offshore structures. 5. List the report regarding design of Structures in Arctic Marine Environment 6. Practice the various stages in construction of offshore structures.			

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	1	3	-	2	3	1	-	-	-	-	-	1	3	3
CO2	2	1	2	3	3	2	1	-	-	-	-	-	3	1	-
CO3	2	1	3	2	2	3	2	-	-	-	-	-	3	1	1
CO4	1	1	3	2	2	3	3	-	-	-	-	-	2	1	-
CO5	-	1	3	2	3	3	3	-	-	-	-	-	2	3	2
CO6	1	1	1	1	3	3	2	-	-	-	-	-	3	2	-
AVERAGE	1.5	1	2.5	1.7	2.5	2.8	2	-	-	-	-	-	2.3	1.8	1

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

UNIT 1:INTRODUCTION TO CONSTRUCTABILITY **9 Hrs**

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

UNIT II: DEEP WATER OFFSHORE STRUCTURES AND SUBSEA SYSTEM **9 Hrs**

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

UNIT III: REMOVAL OF OFFSHORE PLATFORMS **9 Hrs**

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

UNIT IV: ARCTIC MARINE STRUCTURES **9 Hrs**

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

UNIT V: ARCTIC MARINE ENVIRONMENT AND GEOTECHNICS **9 Hrs**

Arctic Marine Structures, Atmospheric Conditions, Darcy's law and its validity, Factors affecting permeability, Laboratory permeability tests, Permeability of stratified soil masses, Seepage pressure, Quick condition, Flow nets.

Total: 45 Hours

TEXT BOOKS

1. Libros Y Manuels de Ignertia, Construction of Marine and Offshore Structures third Edition.
2. API recommended practice 2A-WSD, Recommended practice for Planning, Designing and construction fixed offshore platform working stress design method

REFERENCE BOOKS:

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

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA704	Finite Element Analysis of Offshore Structures	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 interpret the finite element analysis approach related to structural analysis . 2. To interpret the numerical integration on structural analysis . 3. To practice the methods of installation and commissioning needs.
Course Outcome	After completion of the course, the students will be able to: 1. Identify the FEA methods to study structural analysis 2. Analyze basic finite element concepts on spring, truss & beam. 3. Analyze structural plane & spaces element 4. Interpret two dimensional boundary values on various elements. 5. Apply numerical integration on various elements. 6. Practice computational skill using finite element analysis approach.

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	3	1	1	-	-	-	-	-	3	2	-
CO2	1	3	3	1	3	2	2	-	-	-	-	-	1	2	3
CO3	1	3	3	-	3	2	2	-	-	-	-	-	1	2	3
CO4	1	3	3	-	3	2	2	-	-	-	-	-	-	3	3
CO5	-	2	3	1	3	2	2	-	-	-	-	-	-	2	3
CO6	-	2	3	2	3	3	3	-	-	-	-	-	1	3	3
AVERAGE	1	2.7	3	1	3	2	2	-	-	-	-	-	1	2.3	2.5

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

UNIT I: APPROXIMATION METHODS **12 Hrs**

FEA intro, approximate solution of boundary value problems-Methods of weighted residuals, approximate solution using variational method, Modified Galerkin method, Boundary conditions and general comments

UNIT II: SPRING, TRUSS, BEAM ELEMENT **12 Hrs**

Basic finite element concepts-Basic ideas in a finite element solution, General finite element solution procedure, Finite element equations using modified Galerkin method, Application: Axial deformation of bars, Axial spring element. Analysis of trusses-Two dimensional truss element, Three dimensional space truss element,. Beam bending-Governing differential equation for beam bending, Two node beam element, Exact solution for uniform beams subjected to distributed loads using superposition, Calculation of stresses in beams.

UNIT III: PLANE & SPACE FRAME ELEMENT **12 Hrs**

Analysis of structural frames-Plane frame element. Three dimensional space frame element Column buckling. Higher order elements for one dimensional problems-Shape functions for second order problems, Iso-parametric mapping concept, Quadratic Iso-parametric element for general one dimensional boundary value problem, One dimensional numerical integration.

UNIT IV: SHAPE FUNCTION, TYPES OF ELEMENT **12 Hrs**

Two dimensional boundary value problems using triangular elements, Equivalent functional for general 2D BVP, A triangular element for general 2D BVP, Numerical examples. Iso- parametric quadrilateral elements-Shape functions for rectangular elements, Iso-parametric mapping for quadrilateral elements, Numerical

integration for quadrilateral elements, Four node quadrilateral element for 2D BVP, Eight node serendipity element for 2D BVP. Iso- parametric triangular elements-Natural (or Area) coordinates for triangles, Shape functions for triangular elements, Natural coordinate mapping for triangles, Numerical integration for triangles, Six node triangular element for general 2D BVP.

UNIT V: NUMERICAL INTEGRATION **12 Hrs**

Introduction to Nonlinear Problems: Nonlinear problems and some solution methods, geometric and material nonlinearity, problems of gaps and contacts, geometric nonlinearity, modelling considerations.
Gauss-Leguerre rule, Multiple integrals, Numerical integration for quadrilateral elements

TOTAL: 60 HOURS

TEXTBOOKS:

1. Bhatti, M.A., Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Wiley, 2005.
2. Reddy, J. N., An Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill Science/Engineering/Math, 2005.
3. 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"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA610	Quality Health Safety and Environmental Management	L	T	P	C
		2	0	0	2

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 explain the importance of quality control in engineering. 2. To interpret the various concepts in quality control. 3. To choose the corresponding international standards.
Course Outcome	After completion of the course, the students will be able to: 1. Apply the various quality control concepts. 2. Identify appropriate quality control tools to various problems. 3. Practice ISO 9000 management system. 4. Practice health & safety system in shipping building industry. 5. Practice ISM code in ship building industry. 6. Practice the various QA&QC concepts in shipping industry.

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	1	2	3	3	3	-	-	-	-	-	-	3	-	3
CO2	-	3	3	3	3	3	3	-	-	-	-	-	1	3	2
CO3	-	-	3	2	3	3	3	-	-	-	-	-	3	-	2
CO4	-	2	3	2	3	3	2	-	-	-	-	-	-	1	3
CO5	-	3	2	3	2	2	3	-	-	-	-	-	1	1	1
CO6	-	3	2	3	3	2	3	-	-	-	-	-	3	-	2
AVERAGE		2	2.5	2.7	2.8	2.7	2.3	-	-	-	-	-	1.8	0.8	2.2

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

UNIT I: QUALITY CONCEPTS **6 Hrs**

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 IN SHIPPING INDUSTRY **6 Hrs**

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: QUALITY MANAGEMENT SYSTEM **6 Hrs**

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: OCCUPATIONAL HEALTH AND SAFETY **6 Hrs**

Introduction to Basic Concepts of Environmental management system (ISO 14001:2004 EMS), 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: ISM CODES **6 Hrs**

Introduction to ISM code -Background and purpose. Documentation, planning for shipboard operations and Response.Certification of Both DOC (Document of compliance for company) and SMC (Safety Management certificate for ship).

Total 30 Hours

TEXT BOOKS

1.Total Quality Management By Dale. H.Besterfield and Others – PEARSON Education Inc (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, R.Ramakrishnan by Dhanam publications – Chennai – 600042

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"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA705	Offshore Standards and Recommended Practices	L	T	P	C
		2	0	0	2

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 identify the various codal provisions related to deep water offshore structures 2. To identify the role of Classification Societies and Registration Authorities 3. To list the Classification Society rules governing local structural design and global hull girder longitudinal strength.
Course Outcome	After completion of the course, the students will be able to: 1. Apply API code to design offshore structure. 2. Practice Strength analysis of various offshore structures based upon DNV RP codes & standards. 3. Apply API code to design driller & risers 4. Apply API & ISO 13628 Design to subsea system 5. Recognize NACE, AWS standards in analysis of offshore structure. 6. Practice the various standards in analyzing offshore structures.

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	2	3	3	2	3	2	-	-	-	-	-	-	1	2
CO2	1	2	3	3	3	1	1	-	-	-	-	-	1	3	2
CO3	1	3	3	1	3	2	2	-	-	-	-	-	-	1	2
CO4	1	3	3	1	3	2	2	-	-	-	-	-	1	3	2
CO5	1	2	1	1	3	3	3	-	-	-	-	-	-	2	3
CO6	1	2	3	2	3	2	3	-	-	-	-	-	1	3	3
AVERAGE	1	2.3	2.7	1.8	2.8	2.2	2.2	-	-	-	-	-	0.5	2.2	2.3

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

UNIT I: API CODE **6 Hrs**
MODU RULES API CODE

UNIT II: DNV RP CODES **6 Hrs**
DNV RP CODES AND RECOMMENDED PRACTICES NORSKE STANDARDS

UNIT III: API OFFSHORE **6 Hrs**
API 16Q for drilling riser
API 2RD for production Riser

UNIT IV: DESIGN AND OPERATION CODES **6 Hrs**
API 17 A Design and operation of subsea production system API 17 B for Flexible pipes, API 17 C to K ISO 13628 Design and operation of subsea system.

UNIT V: IMO **6 Hrs**
AWS NACE IMO

TOTAL: 30 HOURS

TEXT BOOKS:
1.Dawson, T.H., Offshore Structural Engineering Prentice Hall, 1983

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

REFERENCE BOOKS:

1.Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
2.B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.
3.Subrata K Ckakrabarti., Handbook of Offshore Engineering Vol 1
4.Subrata K Ckakrabarti., Handbook of Offshore Engineering Vol 2

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA706	Warship Design & Construction	L	T	P	C
		3	0	0	3

Year and Semester	IV Year (semester VII)	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. To outline the basic design concepts of warships. 2. To discuss about the advanced technologies used in warships.. 3. To recognize the submarine design and control system.
Course Outcome	After completion of the course, the students will be able to: 1. List the types of warships. 2. Identify the various technologies in warship s 3. Recognize the designing of warships. 4. Discuss about submarine design and control system. 5. List the role &purpose of Frigates & Destroyers. 6. Explain about the features of warships.

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	2	3	3	1	-	-	-	-	-	3	1	1
CO2	3	-	2	3	2	3	2	-	-	-	-	-	-	2	2
CO3	2	-	2	2	3	3	2	-	-	-	-	-	3	1	-
CO4	2	-	2	3	3	2	3	-	-	-	-	-	3	1	1
CO5	3	-	3	2	2	3	3	-	-	-	-	-	3	1	-
CO6	3	1	3	2	3	3	2	-	-	-	-	-	3	1	-
AVERAGE	2.7	0.2	2.5	2.3	2.5	2.8	2.2	-	-	-	-	-	2.5	1.2	0.7

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

UNIT 1:INTRODUCTION TO WARSHIPS **9 Hrs**

Utility Concept of warships, Type of Warships, Classification of warships and their functions, Systems and Subsystems of warships, Design stages, Boundaries, Cost effectiveness, Phases of warship Design, NBCD warfare, Definition, Precautions, NBCD effects, counteracting measures.

UNIT II: ADVANCED WARSHIP TECHNOLOGIES **9 Hrs**

Tracking, recognition and counteracting, precautions in warships, Acoustic, resonance, magnetic and wave track, Type of propulsion, Accommodation, space estimates, Ship fitting influences on weapon systems.

UNIT III: DESIGN AND CONSTRUCTION OF WARSHIPS **9 Hrs**

Design and Construction of warships, Design spiral, rules for classification , Warship specifications and standards, ships form and dimensions and ratios and effect of Block coefficient, Prismatic coefficient, Manoeuvring characteristics, Capacity, Shock, Subdivision, damage, Electronical Interactions, human factors.

UNIT IV: SUBMARINE DESIGN AND CONTROL SYSTEMS **9 Hrs**

Submarine Design, features, General Arrangements, Features of Naval Submarines, Functions of Naval Submarines, Capabilities of Naval submarines, Dual propulsion systems, Major difference between a surface ship and Submarine, Submarine Design aspects- Hydrostatics, Stability and special tests in Submarines, Strength including hull buckling, Dynamic Stability, Powering, Control of internal atmosphere in submarines, Commercial Submarines- Features and functions, AIP Systems, Electrical generation.

UNIT V: FRIGATES AND DESTROYERS **9 Hrs**

Role of these Ships, Lines plan of Frigates and Destroyers, General Purpose Ship, Weapon Systems Selection, Communication Systems, Typical Weapon Systems, Integration of Ship, Sensors and weapon systems, Fighting Capabilities, Propulsion Machinery.

Total: 45 Hours

TEXT BOOKS

1.Ramson & Tupper, Basic Ship Theory
2.EE Allimendinger, Submersible vehicle systems design. SNAME, 1990.

REFERENCE BOOKS:

1.Naval Forces, Jane‘s Fighting Ships
2.Naval Forces, Naval Weapon Systems
3.Naval Forces, Navy International
4.Journal of Naval Engineers.

Designed by	“ Department of Naval Architecture & Offshore Engineering”

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA707	Marine Robotics	L	T	P	C
		3	0	0	3

Year and Semester	IV Year (semester VII)		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. To explain the basics of underwater vehicles. 2. Identify AUVs, its design, propulsion and Control. . 3. To analyse the conceptual design & path planning of UV
Course Outcome	After completion of the course, the students will be able to: 1. Recognize the history of underwater vehicles. 2. Identify the design & performance of underwater vehicles. 3. List the various inherent systems in underwater vehicles. 4. Integrate advanced technologies with UV. 5. Practice the path planning of UV. 6. Develop AUVs according to the owner requirements..

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	2	-	-	-	-	-	3	-	-
CO2	3	2	1	-	2	2	2	-	-	-	-	-	3	1	3
CO3	3	-	1	2	2	2	-	-	-	-	-	-	3	1	-
CO4	3	1	2	2	2	3	-	-	-	-	-	-	3	1	-
CO5	3	-	2	2	2	2	-	-	-	-	-	-	3	3	-
CO6	3	2	3	3	3	2	2	-	-	-	-	-	1	3	2
AVERAGE	3	0.8	1.5	1.5	2.2	2.2	1	-	-	-	-	-	2.7	1.5	0.8

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

UNIT 1: HISTORY OF UVS. **9 Hrs**

History, Evolution of Underwater vehicles (UV), UV types, UV objective/function

UNIT II: INTRODUCTION TO AUVS **9 Hrs**

Introduction - Design methodology - Design calculation - Performance evaluation - Control and system study. Concept of design optimization

UNIT III: INHERENT SYSTEM OF UV **9 Hrs**

Sensors, Propulsion system - Control loop study (i.e. how UV respond to sensor inputs), Mission oriented study of UV - Existing UV study e.g. SLOCUM, Autosub.

UNIT IV: CONCEPTUAL DESIGN **9 Hrs**

Internal system and design study - Safety in design - Conventional shape of submarine - Concept of mini-submarine

UNIT V: PATH PLANNING OF UV **9 Hrs**

Maneuvering in the determined path, Motion planning methods - application e.g. AUV as trench hull survey

Total: 45 Hours

TEXT BOOKS

1.E. Eugene Allmendinger, Submersible vehicle systems design

2.Nuno A. Cruz, Autonomous underwater vehicles

3.Robert D. Christ, The ROV Manual.

REFERENCE BOOKS:

1. Tadahiro Hyakudome, Design of Autonomous Underwater Vehicle

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA708	Design of Floating Offshore Structures	L	T	P	C
		3	0	0	3

Year and Semester	IV Year (semester VII)		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. To design different floating offshore structures. 2. To explain the functions and corresponding design configurations for floating offshore structures. 3. To discuss on size, weight and buoyancy estimation, construction and installation of different floating offshore platforms.
Course Outcome	After completion of the course, the students will be able to: 1. Practice designing of semi-submersible platform. 2. Practice designing of tension leg platform. 3. Practice designing of SPAR platform.. 4. Practice designing of FPSO. 5. Practice designing of Drill ships. . 6. Explain the various platforms design features.

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	1	3	2	1	-	-	-	-	-	3	2	1
CO2	3	2	3	1	3	2	1	-	-	-	-	-	3	2	1
CO3	3	2	3	1	3	2	1	-	-	-	-	-	3	2	1
CO4	3	2	3	1	3	2	1	-	-	-	-	-	3	2	1
CO5	3	2	3	1	3	2	1	-	-	-	-	-	3	2	1
CO6	3	1	2	2	3	2	1	-	-	-	-	-	3	2	1
AVERAGE	3	1.8	2.8	1.2	3	2	1	-	-	-	-	-	3	2	1

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

UNIT 1: SEMI-SUBMERSIBLE PLATFORMS **9 Hrs**

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

UNIT II: TENSION LEG PLATFORMS **9 Hrs**

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

UNIT III: SPAR PLATFORMS **9 Hrs**

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

UNIT IV: FPSOs **9 Hrs**

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

UNIT V: DRILL SHIPS **9 Hrs**

Design considerations, hydrostatic calculations, total strength assessment, topside and hull interface, material selection.

Total: 45 Hours

TEXT BOOKS

1. Jeo Kee Paik and Anil kumar Thayampalli, Ship shape offshore installation, design, building and operation.

2. Subrata Chakrabarthi, Hand book of offshore engineering.
3. Hiroshi Iwasaki, Preliminary design study of Tension leg Platform.

REFERENCE BOOKS:

1. API, ABS, DNV codes.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA7PA	Ship Design Calculation Drawing & Drafting – V SDCADD-V	L	T	P	C
		0	0	6	3

Year and Semester	IV Year (semester VII)		Contact hours per week (6Hrs)	
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 express various piping systems and pipe routing along with HVAC system. 2. To practice docking & launching calculation. 3. To illustrate various arrangements in ship.
Course Outcome	After completion of the course, the students will be able to: 1. Identify the various piping systems. 2. Explain about the HVAC system. 3. Explain the structural arrangement of ships. 4. Show & practice the launching plan & calculations 5. Identify the delivery preparation & trials. 6. Express the various stages in ship building & delivery.

POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
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. HVAC Schematic diagram ,Pipe Design- Piping diagram for fluid systems of a ship. (Sanitary supply & discharge
2. Fuel oil system, lube oil system, Sea water cooling and fresh water cooling, compressed air system, Bilge and ballast system, drain pipe internal /external, etc.) ,Air ventilation system
3. Structural fire protection plan, Fire control and safety plan, Arrangement of life saving plan, Arrangement of exits
4. Anchor arrangement, mooring arrangement, Antenna arrangement, sounding pipe arrangement.
5. Launching methods, calculation and curves, side launch cradle, releasing and starting..
6. Stability tests, dry docking, docking calculations, sea trials & delivery.

TOTAL: 90 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

3. Principle of naval architecture, vol I II & III.

REFERENCE BOOKS:

Principle of naval architecture, vol I II & III.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA7PB	Software Lab- Primavera/ Nomitech- & PDMS	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 practice the PDMS design software. 2. To practice the pipe line design using the software. .
Course Outcome	After completion of the course, the students will be able to: 1. Explain the basics about PDMS & piping module. 2. Practice the software in creating & modifying equipment. 3. Practice pipe work modeling & modification. 4. Practice the orientation of pipe line using the software 5. Schedule pipeline commissioning and operations. 6. Interpret the piping design, commissioning and operation using software.

POS/COS	PO 1	PO 2	PO3	PO 4	PO5	PO 6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	-	1	2	3	2	1	-	-	-	-	-	3	2	3
CO2	3	-	3	2	3	3	2	-	-	-	-	-	1	2	3
CO3	3	-	2	3	2	3	2	-	-	-	-	-	1	2	3
CO4	3	-	3	1	3	1	1	-	-	-	-	-	1	3	3
CO5	2	1	2	2	3	3	1	-	-	-	-	-	2	2	1
CO6	3	1	2	3	2	3	1	-	-	-	-	-	1	2	3
AVERAGE	2.8	0.3	2.2	2.2	2.7	2.5	1.3	-	-	-	-	-	1.5	2.2	2.7

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

LIST OF EXPERIMENTS

1. Working with 3D view, using command window, Clash detection representative tools, working plane, construction lines.
2. Create Equipment: Creating Primitives, Creating Standard Equipment Utilities, Attributes, Attributes Global.
3. Modify Equipment, Equipment: Properties, Specification, Nozzle Specification, Positioning Equipment, Model editor, etc.,
4. Pipe Work Modeling: Pipe work Hierarchy, Pipe Work Orientation, Create branch, connecting pipe, placing pipe, branch replacing, Pipe create by model editor, pipe creation by command line, pipe insulation, material selection of pipe, create co ordinate piping.
5. Modify Pipe Routing: Modify branch, Modify specification, Modify orientation, Reselect of branch, branch explicit, modify connection type, modify BOP/TOP, Dragging pipe ,route splitting , change co ordinate.
6. Pipe sloping, auto sloping, component orientation, sloping and falling of pipe, line stub.

Total: 30 Hours

TEXT BOOKS

1. PDMS MANUALS

REFERENCE BOOKS:

1. PDMS TRAINING MANUALS

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA7PC	Shipyard Training	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	To undergo training in the shipyard to understand the process in ship building .			
Course Outcome	After completion of the course, the students will be able to: 1. List various equipment available in a shipyard 2. Define the shipyard process 3. Observe various process happening in the shipyard 4. Sketch the shipyard layout 5. Practice possible work to help the personnel in the shipyard 6. Practice various calculations need for shipyard			

POS/COS	PO 1	PO 2	PO3	PO 4	PO5	PO 6	PO7	PO 8	PO9	PO 10	PO1 1	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	2	3	2	1	1	1	1	-	-	3	2	3
CO2	3	3	3	2	3	3	2	1	1	1	-	-	2	2	3
CO3	3	3	2	3	2	3	2	1	1	1	-	-	2	2	3
CO4	3	3	3	1	3	1	1	1	1	1	-	-	2	3	3
CO5	2	2	2	2	3	3	1	1	1	1	-	-	2	2	2
CO6	3	2	2	3	2	3	1	1	1	1	-	-	2	2	3
AVERAGE	2.83	2.67	2.5	2.17	2.67	2.5	1.33	1.0	1.0	1.0	-	-	2.17	2.17	2.83

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

The students will have the opportunity to undergo shipyard training in the leading shipyards in India and in abroad for a period of one to three months, At the end of the training the students should submit the daily log book and the training report and undergo a viva for evaluation.

TOTAL: 30 HOURS

REFERENCES

1. Shipyard training manuals

Designed by	" Department of Naval Architecture & Offshore Engineering"

SEMESTER VIII

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA801	Production and Project Management	L	T	P	C
		3	0	0	3

Year and Semester	IV Year (semester VIII)		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. To practice the concepts and issues of project management in shipyard. 2. To identify various project management tools. 3. To apply the new production techniques used in ship manufacturing industry.
Course Outcome	After completion of the course, the students will be able to: 1. List the stages involved in production design & application. 2. Practice process planning in shipbuilding. 3. Interpret capacity planning in ship building. 4. Apply production planning in shipbuilding. 5. Practice launching calculation & Shipyard layout. 6. Express the various stages involved in ship building process.

POS/COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	2	2	2	2	1	-	-	-	-	-	3	1	-
CO2	2	2	2	2	3	3	1	-	-	-	-	-	2	2	1
CO3	1	2	3	3	2	2	1	-	-	-	-	-	3	2	1
CO4	1	2	3	2	3	3	2	-	-	-	-	-	1	3	2
CO5	1	2	3	2	2	2	2	-	-	-	-	-	1	3	2
CO6	2	2	3	2	3	3	2	-	-	-	-	-	1	3	3
AVERAGE	1.7	2	2.7	2.2	2.5	2.5	1.5	-	-	-	-	-	1.8	2.3	1.8

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

UNIT-1 : PRODUCTION DESIGN **9 Hrs**

Production design - application of the principles of design for production in shipbuilding - joining of parts; relations between structural design and prefabrication, simplifications in structural design (design for welding), quality control. Problems of accuracy - tolerances, standards, measuring techniques (theodolite, laser, etc) quality control.

UNIT-II: PROCESS PLANNING **9 Hrs**

Process planning in shipbuilding :-Planning for operations - interconnection between production design and process planning, production and process analysis, assembly charts, operation process charts, flow process charts; Process selection. Application of models for process planning, scheduling and control - Gantt charts, CPM & PERT, transportation models etc.; Special aspects of application of these in shipbuilding process. Procedure control and systems, control of production, time and motion study, material control and plant safety, industrial relations, personal management, training human relations, labour organization, dry docking and maintenance of ships.

UNIT-III: CAPACITY PLANNING **9 Hrs**

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

UNIT-IV: PRODUCTION STANDARDS **9 Hrs**

Production standards - production standards in several parts of the ship production. process. Work measurement systems, methods of man - hour determination, use of computers, correlation between size of series and needed man – hours. Systems of maintenance and quality control.

UNIT-V: LAUNCHING CALCULATIONS **9 Hrs**

Launching methods, calculation and curves, side launch cradle, releasing and starting, stability tests, dry docking, docking calculations, sea trials & delivery.

Total Hours : 45

TEXT BOOKS

1. Taggart; ship design and construction, SNAME chapter 15, 1980
2. Storch R. Lee, Hammon C.P. & Bunch H.M..; Ship Production, Cornell Maritime Press, Maryland, USA, 1988
3. Heizer and Render. Production and Operations Management, 3rd or later Edition
4. J K Sharma , Operations Research – Theory and Applications , Laxmi Publications

REFERENCE BOOKS

1. Dormidontov V. K. & et.al; Shipbuilding Technology, Mir publishers, Moscow.
2. Eyres D.J.; Ship Construction William Heinemann Ltd, London, 1982
3. Buffa, Modern production operations management, 6th edition, Wiley 1980
4. P Khanna , Industrial Engineering and Management , Dhanpat Rai 1980

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UANA8PA	Ocean Engineering& Marine Hydrodynamics- Model Testing	L	T	P	C
		0	0	4	2

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 techniques involved in model making and model testing for ship hydrodynamics
Course Outcome	After completion of the course, the students will be able to: 1. Describe various model making techniques available for floating bodies 2. Construct a ship model 3. Perform basic experiments related to ship hydrodynamics 4. Explain various stages in model preparation for resistance tests 5. Define the ITTC standards in model testing 6. Calculate Resistance and propeller characteristics with the available data

POS/COS	PO 1	PO 2	PO3	PO 4	PO5	PO 6	PO7	PO 8	PO9	PO 10	PO1 1	PO 12	PS O1	PS O2	PS O3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO4	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO5	2	2	2	1	1	-	-	1	2	2	2	1	1	2	2
CO6	2	2	1	1	1	-	-	1	2	2	2	1	1	2	2
AVERAGE	2	2	1.8	0.3	1	-	-	1	1.7	2	2	1	1	2	2

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

LIST OF EXPERIMENTS

1. Learn the model making techniques to make a ship model
2. Using Scaling techniques creating a physical model of an actual ship
3. Model preparation for resistance and sea keeping tests
4. IITC standards of model tests and Method of IITC 1978 resistance prediction method
5. Carryout model testing in the wave tank and observing the data as output
6. Open water characteristics of model

Total Hours : 60

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 UANA8PB	Major Design Project	L	T	P	C
		0	0	16	8

Year and Semester	IV Year (semester VIII)		Contact hours per week (16Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	To carry out a design project in naval architecture and offshore engineering			
Course Outcome	After completion of the course, the students will be able to: 1. Describe the components on a ship design project 2. Estimate hydrostatic calculations for the selected vessel 3. Sketch lines plan and general arrangement for the given vessel 4. Predict the resistance and propulsive characteristics of the vessel 5. Perform the scanting calculations for the vessel 6. Evaluate the ship [performance in calm and wave conditions			

POS/COS	PO1	PO 2	PO3	PO 4	PO5	PO 6	PO7	PO 8	PO9	PO 10	PO1 1	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	2	1	1	1	1	1	2	2	1	2	3	3
CO2	3	3	3	2	1	1	1	1	1	2	2	1	3	3	3
CO3	3	3	3	2	1	1	1	1	2	2	2	1	3	3	3
CO4	3	3	3	2	1	1	1	1	2	2	2	1	3	3	3
CO5	2	2	2	1	1	1	1	1	2	2	2	1	2	2	2
CO6	2	2	1	1	1	1	1	1	2	2	2	1	2	2	2
Average	2.7	2.7	2.5	1.7	1	1	1	1	1.7	2	2	1	2.5	2.7	2.7

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

Each student will be allotted one ship or offshore structure related project for the design work and they will complete the Project in Semester-VIII, using both manual and software for calculation, design and submit the Project report and undergo a viva for evaluation.

REFERENCES

3. Practical Ship Hydrodynamics. Volker Bertram, Butterworth-Heinemann, 2000
4. Dynamics of Marine Vehicles, R Bhattacharya, 1978

Designed by	" Department of Naval Architecture & Offshore Engineering"