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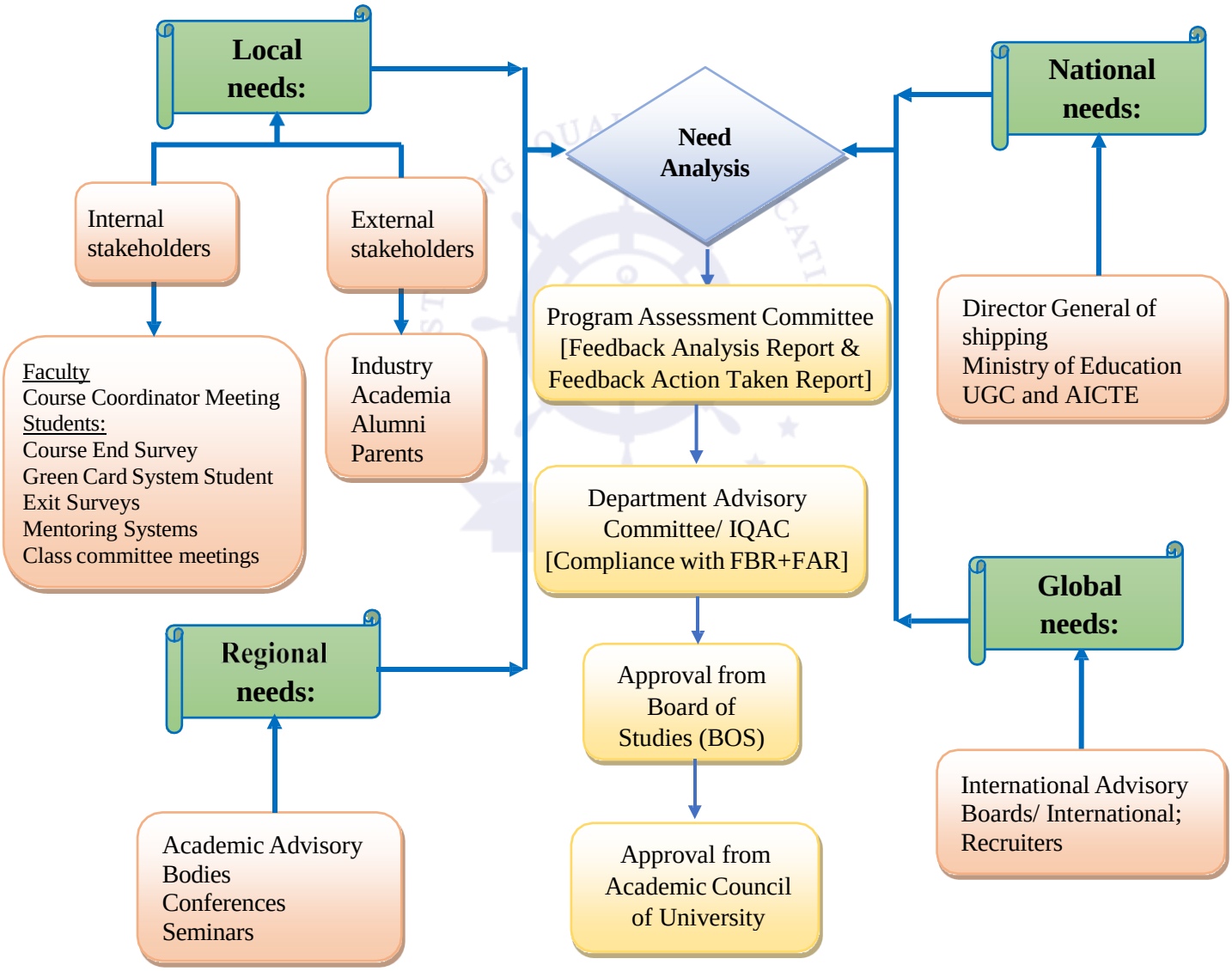
CURRICULUM DESIGN PROCESS



Process for designing program curriculum

CHOICE BASED CREDIT SYSTEM

(Applicable to all students registering from the academic year 2023 onwards)

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF NAVAL ARCHITECTURE AND OFFSHORE ENGINEERING

UG ENGINEERING CURRICULUM

ACADEMY OF MARITIME EDUCATION AND TRAINING

DEEMED TO BE UNIVERSITY

135, EAST COAST ROAD

KANATHUR, CHENNAI – 603112

About the Institution

India's first deemed to be University under Section 3 of UGC Act 1956 for maritime education, training and research. It is a pioneering University with membership in International Association of Maritime Universities (IAMU), Japan. AMET is ranked THIRD among the Maritime Universities of World in PIMET (Performance Indicators in Maritime Education and Training) Ranking of the IAMU for three consecutive years. The Director General of Shipping has accredited University with A1 outstanding Grade for the past FIVE consecutive years for outstanding maritime education and training, which is a rare distinction. Since 25 years AMET has been addressing capacity building to feed national and world industry to support maritime sector. About 4000 students are currently undergoing few specialized like - B.Sc. Nautical Science, B.E. Marine Engineering, B.E. Naval Architecture and Offshore Engineering, B.E. Mining Engineering, B.E. Petroleum Engineering, B.E. Electrical and Electronics Engineering (marine), B.E. Mechanical Engineering (marine), B.Tech. Food Processing Technology, BBA and MBA (Shipping and Logistics), B.Com. Logistics and Computer Applications, besides post graduate studies and research programmes leading to Ph.D degree.

About the Department

Department of Naval Architecture and Offshore Engineering was established in 2007, aspires to impart quality education to the students, train them to enrich their skills and attitude and make them competent and efficient for the maritime sector. The department offers PhD, M.E and B.E programs in Naval Architecture and Offshore Engineering. The department is equipped with well experienced faculties from both academia and industry. We provide solid foundation in wide range of Naval Architectural and offshore engineering aspects such as design, production, construction, structural and hydrodynamic engineering. The department has been constantly updating, the curriculum and syllabus of the programs to meet the latest advances in marine technology. We always set high standards to perform the activities for the benefit of student community in various areas of design and production of ships and offshore structures. Hundreds of our students are placed in various shipyards, marine industries and consultancy firms in India and abroad.

AMET CBCS REGULATION 2023

Vision and Mission of the Department

Vision

To educate and train professionals in Naval Architecture and Offshore Engineering who are academically bright, technically creative, ethically sound, emotionally strong, and valuable to society through innovative teaching, learning and research.

Mission

1. Produce job ready Engineers in the field of Naval Architecture and Offshore Engineering by imparting knowledge in basic sciences and engineering.
2. Inspire students to pursue higher education in Naval Architecture and Offshore Engineering and other allied fields in the maritime sector.
3. Nurture students so that they are innovative, creative, and possess entrepreneurship skills to meet the needs of the industry and society.
4. Establish high quality teaching and research environment to offer state-of-the-art undergraduate, graduate and doctoral programs.
5. Exhibit world-class research capabilities in the field of Naval Architecture and Offshore Engineering.

Program Educational Objectives (PEO's)

PEO 1	Become successful Naval Architects and Offshore Engineers with breadth and depth of knowledge who are competent, innovative and productive in addressing the needs of the industry
PEO 2	Pursue higher education and research in Naval Architecture and Offshore Engineering, and other allied disciplines
PEO 3	Develop innovative thinking skills and pursue a life-long learning process to augment professional growth.
PEO 4	Exhibit high standards of ethical conduct, positive attitude and societal responsibility

Program Outcomes (PO's) & Program Specific Outcomes (PSO's)

Program Outcomes (PO's)	
PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO 11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)	
PSO 1	Develop innovative and contemporary designs of ships and offshore structures to meet the challenges of demanding marine operations, thereby advancing the level of shipbuilding, offshore, and other industries in the maritime sector.
PSO 2	Apply engineering design and construction concepts to produce solutions in the field Of Naval Architecture and Offshore Engineering.
PSO 3	Develop technological and scientific competence at the highest level; excel in state of-the- art research and development in Naval Architecture, Offshore Engineering, and other allied areas that require multidisciplinary outlook at world-class R & D facilities and organizations.

GENERAL COURSE STRUCTURE

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: In the light of the fact that a typical Model Four-year Under Graduatedegree program in Engineering has about 160 credits, the total number of credits proposed for the four-year B. Tech/B.E. in ……Engineering (Engineering & Technology) is kept as 160

C. Credit distribution for courses under different curricular components

Category of Courses	Sem 1	Sem 2	Sem3	Sem4	Sem5	Sem 6	Sem 7	Sem 8	Total
Basic Science Course	**8**	**8**	**2**	**3**	**-**	**-**	**-**	**-**	**21**
Humanities and Social Science including Management Courses	**3**	**4**	**3**	**2**	**-**	**-**	**-**	**-**	**12**
Engineering Science Course	**7**	**8**	**8**	**4**	**-**	**-**	**-**	**-**	**27**
Professional Core Course	**3**	**5**	**8**	**9**	**15**	**13**	**-**	**1**	**54**
Professional Elective Course	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**6**	**15**
Open Elective Course	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**12**
Internship	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**3**	**5**
Project	**-**	**-**	**-**	**2**	**-**	**2**	**10**	**-**	**14**
TOTAL	**21**	**26**	**21**	**27**	**21**	**21**	**10**	**13**	**160**

Credit distribution for courses under different curricular components

CBCS CURRICULUM (2022-23)

Basic Science Courses: (Credits to be earned: 22)

S. No	Course Code	Course Title	L	T	P	C	Prerequisite
1.	236PH1A11TA	Engineering Physics*	3	0	0	3	
2.	236PH1A11PA	Engineering Physics Lab*	0	0	2	1	
3.	236MA1A11TA	Calculus and Linear Algebra*	3	1	0	4	
4.	236CH1A11TA	Engineering Chemistry**	3	0	0	3	
5.	236CH1A11PA	Engineering Chemistry Lab**	0	0	2	1	
6.	236MA1A21TB	Transforms and Differential Equations*	3	1	0	4	236MA1A11TA
7.	236MA1A41TD	Mathematical foundation for AI and Data science*	2	0	0	2	
8.	236MA1A31TC	Probability and Statistics *	3	1	0	4	

Humanities and Social Science including Management Courses: (Credits to be earned: 12)

S. No	Course Code	Course Title	L	T	P	C	Prerequisite
1.	236EN1A12TA	Technical English*	2	0	0	2	
2.	236EN1A12PX	Communication Skills Lab - I *	0	0	2	1	
3.	233MG1AX2TG	Universal Human Values – II Understanding Harmony	3	0	0	3	
4.	236EN1AX2PX	Communication Skills Lab – II*	0	0	2	1	236EN1A12PX
5.	233MG1AX2TB/ 233MG1AX2TC/ 233MG1AX2TF/ 233MG1AX2TI	Total Quality Management**/	3	0	0	3	

		Principles of Management**/ Entrepreneurship and Startups ** / Project Management					
6.	236EN1AX2PX/ 236EN1AX2PX/	Interpersonal Communication / Professional Communication / Design Thinking	0	0	2	1	
7.	236EN1AX2PX/ 236EN1AX2PX/	Interpersonal Communication / Professional Communication / Design Thinking	0	0	2	1	

Engineering Science Courses: (Credits to be earned: 26)

S. No	Course Code	Course Title	L	T	P	C	Prerequisite
1	234CS1A13TB	Python for problem solving*	3	0	0	3	
2	234CS1A13PB	Python for problem solving Lab*	0	0	2	1	
3	232MC1A13TB	Engineering Drawing and Computer Graphics	1	0	4	3	
4	232MC1A33TC	Engineering Mechanics**	3	0	0	3	
5	232EE1AX3TB	Basic Electrical and Electronics Engineering*	3	0	0	3	
6	232EE1AX3PB	Basic Electrical and Electronics Engineering Lab*	0	0	2	1	
7	232NA1A33PA	Engineering Fluid Mechanics **	3	0	0	3	
8	232NA1A33TB	Fluid Mechanics Lab	0	0	2	1	
9	232NA1A33TC	Mechanics of Materials **	3	0	0	3	
10	232NA1A31PA	Mechanics of Materials Lab	0	0	2	1	
11	232NA1A43TA	Artificial Intelligence & Neural Networks*	3	0	0	3	

12	232NA1A43PB	Artificial Intelligence & Neural Networks Lab	0	0	2	1	

Professional Core Courses: (Credits to be earned: 54)

S. No	Course Code	Course Title	L	T	P	C	Prerequisite
1	232NA1A14TA	Introduction to Naval Architecture	3	0	0	3	
2	232NA1A24TB	Elements of Offshore Engineering	3	0	0	3	
3	232NA1A34PC	Ship Drawing - Lines Plan	0	0	4	2	
4	232NA1A34TD	Introduction to Marine Engineering	3	0	0	3	
5	232NA1A34TE	Theory of Ships	3	0	0	3	
6	232NA1A34F	Hydrostatics and Stability Lab	0	0	2	1	
7	232NA1A34G	Surface Modelling and Analysis Lab	0	0	2	1	
8	232NA1A44TH	Marine Hydrodynamics	3	0	0	3	232NA1A33PA
9	232NA1A44TI	Marine Materials & Welding Technology	3	0	0	3	
10	232NA1A44TJ	Thermodynamics & Marine Machinery	3	0	0	3	
11	232NA1A54TK	Strength of Ships	3	1	0	4	232NA1A33TC
12	232NA1A54PL	Ship Strength Lab	0	0	2	1	
13	232NA1A54PM	Structural Modelling & Analysis-Software Lab	0	0	2	1	
14	232NA1A54TN	Ship Resistance and Propulsion	3	0	0	3	232NA1A33PA
15	232NA1A54TO	Ship Construction	3	0	0	3	232NA1A44TI
16	232NA1A54TP	Ship Systems Engineering	3	0	0	3	
17	232NA1A64TQ	Design of Offshore Structures	3	1	0	4	232NA1A24TB
18	232NA1A64TR	Ship Motion and Control	3	0	0	3	
19	232NA1A64TS	Ship Design	3	0	0	3	

20	232NA1A64PT	Marine Hydrodynamics Lab	0	0	2	1	
21	232NA1A64PU	Offshore Structure Design Lab	0	0	2	1	
22	232NA1A64PV	Ship System Drawing Lab	0	0	2	1	
23	232NA1A84PW	Numerical Ship Hydrodynamics Lab	0	0	2	1	

Professional Elective Courses: (Credits to be earned: 15)

S. No	Course Code	Course Title	L	T	P	C	Prerequisite
Marine Engineering							
1	232NA1A55TA	Marine Engineering –I	3	0	0	3	
2	232NA1A65TB	Marine Pollution	3	0	0	3	
3	232NA1A75TC	Marine Engineering-II	3	0	0	3	

Offshore Engineering							
4	232NA1A55TD	Ocean Data Analysis	3	0	0	3	
5	232NA1A45TE	Renewable Energy Sources	3	0	0	3	
6	232NA1A75TF	Dynamics of Offshore Structures	3	0	0	3	
7	232NA1A55TG	Subsea Pipeline and Risers	3	0	0	3	
8	232NA1A65TH	Coastal Disaster Management	3	0	0	3	
9	232NA1A55TI	Wave Mechanics	3	0	0	3	
10	232NA1A65TJ	Dredging Technology	3	0	0	3	
11	232NA1A75TK	Advanced Offshore Engineering	3	0	0	3	
12		SWAYAM / MOOC Courses	3	0	0	3	
Ship Design							

13	232NA1A55TL	Lifting Surfaces for Marine Applications	3	0	0	3	
14	232NA1A65TM	Fishing Vessel Technology	3	0	0	3	
15	232NA1A65TN	Inland Water Transportation	3	0	0	3	
16	232NA1A75TO	Warship Technology	3	0	0	3	
17	232NA1A75TP	Advanced Fluid Mechanics	3	0	0	3	
18	232NA1A75TQ	Guidance and Control of Marine Vehicles	3	0	0	3	
19	232NA1A75TR	Computer Aided Structural Design	3	0	0	3	
20	232NA1A75TS	Advanced Ship Design	3	0	0	3	
21	232NA1A65TT	Ship Vibration and Noise	3	0	0	3	

Ship Construction							
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Prerequisite**
22	232NA1A75TU	CAD/CAM in Ship Building	3	0	0	3	
23	232NA1A75TV	Statutory Regulations and Classification Rules	3	0	0	3	
24	232NA1A75TW	Shipyard Practices and Project Management	3	0	0	3	
25	232NA1A65TX	Non-Destructive Testing	3	0	0	3	
26	232NA1A75TY	Advanced Ship Technology	3	0	0	3	

Mandatory Courses: (Credits to be earned: 0)

S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**Prerequisite**
1	238LA1A18TA	Universal Human values – Induction Program	3 weeks				-
2	238LA1A28TB	Environmental Science	2	0	0	0	-
3	238LA1A38TC	Indian Constitution	2	0	0	0	-

4	238LA1A48TD	Essence of Indian Traditional Knowledge	2	0	0	0	-
5	238LA1A58TE	Gender Sensitivity	2	0	0	0	-
6	238LA1A68PF	In-plant Training	0	0	0	0	-
7	238LA1A78PG	Paper Publication	0	0	0	0	-

Open Elective Courses: (Credits to be earned: 12)

S. No	Course Code	Course Title	L	T	P	C	Prerequisite
1	232NA1A56TA	Basic Principles of Marine Vessel Design	3	0	0	3	-
2	232NA1A56TB	Marine Pollution Regulations	3	0	0	3	-
3	232NA1A56TC	Fundamentals of floating bodies	3	0	0	3	-
4	232NA1A56TD	Fundamentals of Oceanography	3	0	0	3	-
5	232NA1A56TE	Ocean Energy	3	0	0	3	-
6	232NA1A66TF	Quality, Health, Safety and Environmental Management	3	0	0	3	-
7	232NA1A66TG	Introduction to Dredging	3	0	0	3	-
8	232NA1A66TH	Basics of Harbor Engineering	3	0	0	3	-
9	232NA1A76TI	Introduction to Engineering Simulations – A Hands-on practice	3	0	0	3	-
10	232NA1A76TJ	Fishing Vessel and Workboat Design	3	0	0	3	-
11	232NA1A76TK	Ocean Observation and Instrumentation techniques	3	0	0	3	-
12	232NA1A56TL	Fundamentals of offshore Engineering	3	0	0	3	-
13	232NA1A66TM	Introduction to Underwater Technology	3	0	0	3	-
14	232NA1A66TN	Pipeline and Riser Engineering	3	0	0	3	-
15	232NA1A66TO	Hull Inspection	3	0	0	3	-
16	232NA1A56TP	Air Pollution and Control	3	0	0	3	-

Mandatory Courses: (Credits to be earned: 0)

S. No	Course Code	Course Title	L	T	P	C	Prerequisite
1	**238LA1A18A**	Universal Human values – Induction Program	3 weeks				-
2	**238LA1A28B**	Environmental Science	2	0	0	0	-
3	**238LA1A38C**	Indian Constitution	2	0	0	0	-
4	**238LA1A48D**	Essence of Indian Traditional Knowledge	2	0	0	0	-
5	**238LA1A58E**	Gender Sensitivity	2	0	0	0	-
6	**238LA1A68F**	In-plant Training	0	0	0	0	-
7	**238LA1A78G**	Paper Publication	0	0	0	0	-

Value Added Courses: (Credits to be earned: 0)

S. No	Course Code	Course Title	L	T	P	C	Prerequisite
1	232NA1A19PA	**VAC 1-** Application of Computer-Aided Design (CAD) in ship Design	2	0	0	0	-
2	232NA1A29PB	**VAC- 2-** Application of FRP in Ship Building	2	0	0	0	-
3	232NA1A39PC	**VAC- 3-** Advanced Welding Technology in Shipbuilding	2	0	0	0	-
4	232NA1A49PD	**VAC-4-** Non Destructive Testing (NDT) in Shipbuilding	2	0	0	0	-
5	232NA1A59PE	**VAC-5-** Fundamentals of Warship Design	2	0	0	0	-
6	232NA1A69PF	**VAC-6-** Vibration of Marine Structures	2	0	0	0	-

Internship: (Credits to be earned: 5)

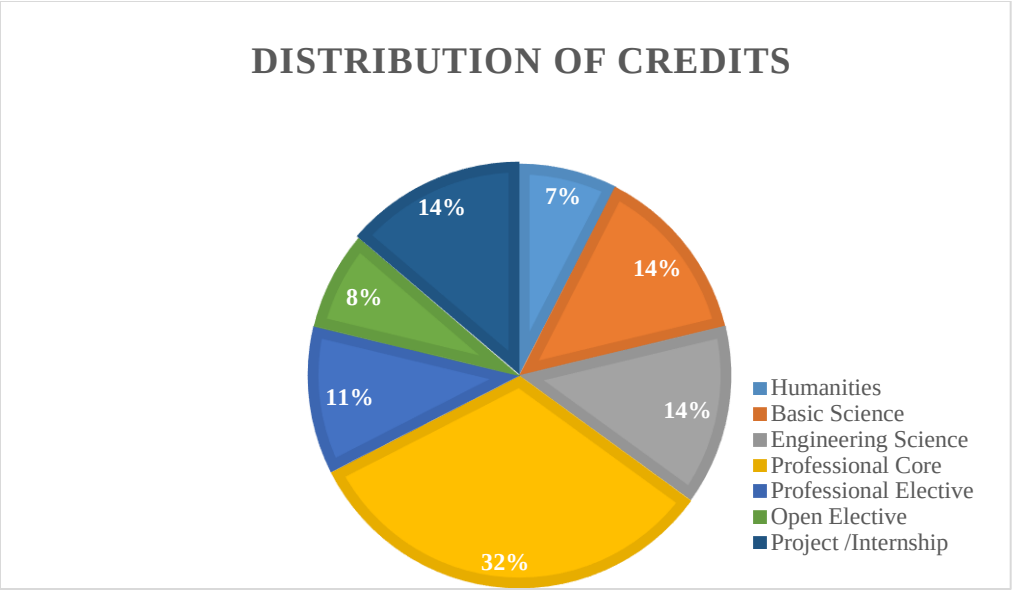
S. No	Course Code	Course Title	L	T	P	C	Remarks
1	232NA1A27PA	Internship 1	0	0	0	1	During II Year Summer Vacation
2	232NA1A47PB	Internship 2	0	0	0	1	During III Year Summer Vacation
3	232NA1A77PC	Internship 3	0	0	0	3	During VII Sem

Project: (Credits to be earned: 14)

S. No	Course Code	Course Title	L	T	P	C	Remarks
1	232NA1A47PA	Design / Mini Project -I	0	0	0	2	During IV Sem
2	232NA1A67PB	Design/ Mini Project -II	0	0	0	2	During VI Sem
3	232NA1A87PC	Project -III	0	0	0	10	During VIII Sem

Distribution of Credits

As Per	Humanities	Basic Science	Engineering Science	Professional Core	Professional Elective	Open Elective	Project /Internship	Total
AICTE	**12**	**25**	**24**	**48**	**18**	**18**	**15**	**160**
AMET (Proposed)	**12**	**22**	**22**	**52**	**18**	**15**	**19**	**160**



FACULTY OF ENGINEERING AND TECHNOLOGY

CURRICULUM FOR B.E. NA&OE

ACADEMIC YEAR – 2023-24

SEMESTER I

S. No	Course Code	Category	Course Title	Contact Hours	L	T	P	C	Exam Hrs
THEORY									
1	236EN1A12TA	Humanities and Social Science	Technical English	**2**	**2**	**0**	**0**	**2**	**3**
2	236PH1A11TA	Basic Science	Engineering Physics	**3**	**3**	**0**	**0**	**3**	**3**
3	236MA1A11TA	Basic Science	Calculus and Linear Algebra	**4**	**3**	**1**	**0**	**4**	**3**
4	234CS1A13TB	Engineering Science	Python for Problem Solving	**3**	**3**	**0**	**0**	**3**	**3**
5	232NA1A14A	Professional Core	Introduction to Naval Architecture	**3**	**3**	**0**	**0**	**3**	**3**
6	232NA1A19	In – House Program	VAC 1-Application of FRP in Ship Building	**30 Hrs**					
PRACTICALS									
7	236EN1A12PX	Humanities and	Communication Skills Lab 1	**2**	**0**	**0**	**2**	**1**	**3**

		Social Science							
8	236PH1A11PA	Basic Science	Engineering Physics Lab	**2**	**0**	**0**	**2**	**1**	**3**
9		Engineering Science	Python for Problem Solving Lab	**2**	**0**	**0**	**2**	**1**	**3**
10	232MC1A13TB	Engineering Science	Engineering Drawing and Computer Graphics	**5**	**1**	**0**	**4**	**3**	**3**
11	238LA1A18A	Mandatory	Universal Human Values I– Induction Program						
			TOTAL	**26**	**12**	**1**	**10**	**21**	**-**

***L- Lecture; T-Tutorial; P-Practical; C-Credit**

Total Hours Available = **5x7 = 35 Hrs**
Total Hours for regular courses = 30 Hrs (15 Hrs Lec + 3 Hrs Tut + 12 Hrs Pra)
Hours for Aptitude Training = 2Hrs
Mentor- Mentee / Library = 1Hr
Hours for Communication and Personality Development = 2 Hrs

SEMESTER II

S. No	Course Code	Category	Course Title	Contact Hours	L	T	P	C	Exam Hrs
THEORY									
1	238LA1A18A	Humanities and Social Science	Universal Human Values- 2	**3**	**3**	**0**	**0**	**3**	**3**
2	236CH1A11TA	Basic Science	Engineering Chemistry	**3**	**3**	**0**	**0**	**3**	**3**
3	236MA1A21TB	Basic Science	Transforms and Differential Equations	**4**	**3**	**1**	**0**	**4**	**3**
4	232MC1A33TC	Engineering Science	Engineering Mechanics	**3**	**3**	**0**	**0**	**3**	**3**
5	232EE1AX3TB	Engineering Science	Basic Electrical & Electronics Engineering	**3**	**3**	**0**	**0**	**3**	**3**
6	232NA1A24B	Professional Core	Elements of Offshore Engineering	**3**	**3**	**0**	**0**	**3**	**3**
7	232NA1A29B	Industry Connect	VAC 2-Application of FRP in	**30 HRS**					

		Program	Ship Building						
PRACTICALS									
8	236EN1AX2PX	Humanities and Social Science	Communication Skills Lab 2	**2**	**0**	**0**	**2**	**1**	**3**
9	236CH1A11PA	Basic Science	Engineering Chemistry Lab	**2**	**0**	**0**	**2**	**1**	**3**
10	232MC1A23PB	Engineering Science	Workshop Practices	**4**	**0**	**0**	**4**	**1**	**3**
11	232EE1AX3TB	Engineering Science	Basic Electrical and Electronics Engineering Lab	**2**	**0**	**0**	**2**	**1**	**3**
12	232NA1A34C	Professional Core	Ship Drawing - Lines Plan	**4**	**0**	**0**	**4**	**2**	**3**
13	232NA1A27A	Mandatory	Internship 1	**-**	**-**	**-**	**-**	**1**	**1**
TOTAL				**35**	**18**	**1**	**16**	**26**	**-**

***L- Lecture; T-Tutorial; P-Practical; C-Credit**

Total Hours Available = **5x7 = 35 Hrs**
Total Hours for regular courses = 30 Hrs (17 Hrs Lec + 3 Hrs Tut + 10 Hrs Pra)
Hours for Aptitude Training = 2Hrs
Hours for Communication and Personality Development = 2 Hrs
Mentor- Mentee / Library = 1Hr

SEMESTER III

S. No	Course Code	Category	Course Title	Contact Hours	L	T	P	C	Exam Hrs
	THEORY								
1	233MG1AX2TB/ 233MG1AX2TC/ 233MG1AX2TF/ 233MG1AX2TI	Humanities and Social Science	Total Quality Management/Principles of Management/ Entrepreneurship and Startups/ Project Management	**3**	**3**	**0**	**0**	**3**	**3**
2	236MA1A41TD	Basic Science	Mathematical foundation for AI and Data science	**3**	**3**	**0**	**0**	**2**	**3**
3	232NA1A33A	Engineering Science	Engineering Fluid Mechanics	**3**	**3**	**0**	**0**	**3**	**3**

4	232NA1A33C	Engineering Science	Mechanics of Materials	**3**	**3**	**0**	**0**	**3**	**3**
5	232NA1A34D	Professional Core	Introduction to Marine Engineering	**3**	**3**	**0**	**0**	**3**	**3**
6	232NA1A34E	Professional Core	Theory of Ships	**3**	**3**	**0**	**0**	**3**	**3**
7	238LA1A38C	Mand atory	Indian Constitution	**2**	**2**	**0**	**0**	**0**	**3**
8	232NA1A39C	In – House Program	VAC- 3- Advanced Welding Technology in Shipbuilding	**30 Hrs**					
PRACTICALS									
9	232NA1A31A	Engineering Science	Strength of Materials Lab	**2**	**0**	**0**	**2**	**1**	**3**
10	232NA1A33B	Engineering Science	Fluid Mechanics Lab	**2**	**0**	**0**	**2**	**1**	**3**
11	232NA1A34G	Professional Core	Surface Modelling & Analysis Lab	**2**	**0**	**0**	**2**	**1**	**3**
12	232NA1A34F	Professional Core	Hydrostatics and Stability Lab	**2**	**0**	**0**	**2**	**1**	**3**
TOTAL				**28**	**20**	**0**	**8**	**21**	**-**

***L- Lecture; T-Tutorial; P-Practical; C-Credit**

Total Hours Available = **5x7 = 35 Hrs**
Total Hours for regular courses = 29 Hrs (20 Hrs Lec + 3 Hrs Tut + 6 Hrs Pra)
Hours for Aptitude Training = 2Hrs
Hours for Communication and Personality Development = 2 Hrs
Mentor- Mentee / Library = 1Hr, Seminar – 1Hr

SEMESTER IV

S. No	Course Code	Category	Course Title	Contact Hours	L	T	P	C	Exam Hrs
THEORY									
1	236EN1AX2PX/ 236EN1AX2PX/	Humanities and Social Science	Design Thinking / Interpersonal	0	0	0	2	1	3

			Communication/ Professional Communication						
2	236EN1AX2PX/ 236EN1AX2PX/	Humanities and Social Science	Design Thinking / Interpersonal Communication/ Professional Communication	0	0	0	2	1	3
3	236MA1A31TC	Basic Science	Probability and Statistics	3	3	0	0	3	3
4	232NA1A43B	Engineering Science	Artificial Intelligence & Neural Networks	3	3	0	0	3	3
5	232NA1A44H	Professional Core	Marine Hydrodynamics	3	3	0	0	3	3
6	232NA1A44I	Professional Core	Marine Materials & Welding Technology	3	3	0	0	3	3
7	232NA1A44J	Professional Core	Thermodynamics & Marine Machinery	3	3	0	0	3	3
8	232NA1A45E	Professional Elective	PEC 1	3	0	0	0	3	3
9		Open Elective	Online Course 1	-	-	-	-	3	-
10	238LA1A48D	Mandatory	Essence of Indian Traditional Knowledge	2	2	0	0	0	3
11	232NA1A47B	Mandatory	Internship 2	0	-	-	-	1	1
			VAC-4- Non Destructive Testing (NDT) in Shipbuilding	30Hrs					
	PRACTICALS								
13	232NA1A43B	Engineering Science	Artificial Intelligence & Neural Networks Lab	2	0	0	2	1	3
14	232NA1A47PA		Design Project - 1	4	0	0	4	2	3
			TOTAL	26	17	1	9	27	-

***L- Lecture; T-Tutorial; P-Practical; C-Credit**

Total Hours Available = **5x7 = 35 Hrs**
Total Hours for regular courses = 27 Hrs (17 Hrs Lec + 3 Hrs Tut + 7 Hrs Pra)
Hours for Placement Training = 2Hrs
Hours for Aptitude Training = 2Hrs
Hours for Communication and Personality Development = 2 Hrs
Mentor- Mentee / Library = 1Hr

Seminar – 1Hr

SEMESTER V

S. No	Course Code	Category	Course Title	Contact Hours	L	T	P	C	Exam Hrs
THEORY									
1	232NA1A54K	Professional Core	Strength of Ships	**4**	**3**	**1**	**0**	**4**	**3**
2	232NA1A54N	Professional Core	Ship Resistance and Propulsion	**3**	**3**	**0**	**0**	**3**	**3**
3	232NA1A54O	Professional Core	Ship Construction	**3**	**3**	**0**	**0**	**3**	**3**
4	232NA1A54P	Professional Core	Ship System Engineering	**3**	**3**	**0**	**0**	**3**	**3**
5	232NA1A55G	Professional Elective	PEC 2	**3**	**3**	**0**	**0**	**3**	**3**
6	232NA1A56A	Open Elective	Online Course 2	**-**	**-**	**-**	**-**	**3**	**-**
7	238LA1A58E	Mandatory	Gender Sensitivity	**2**	**2**	**0**	**0**	**0**	**3**
8	232NA1A59E	In – House Program	VAC 4 -Non Destructive Testing (NDT) in Shipbuilding	**30 Hrs**					
PRACTICALS									
8	232NA1A54K	Professional Core	Ship Strength Software Lab	**2**	**0**	**0**	**2**	**1**	**3**
9	232NA1A54M	Professional Core	Structural Modelling & Analysis- Software Lab	**2**	**0**	**0**	**2**	**1**	**3**
			TOTAL	**22**	**17**	**1**	**4**	**21**	**-**

***L- Lecture; T-Tutorial; P-Practical; C-Credit**

Total Hours Available = **5x7 = 35 Hrs**
Total Hours for regular courses = 27 Hrs (20 Hrs Lec + 3 Hrs Tut + 4 Hrs Pra)
Hours for Placement Training = 2Hrs
Hours for Aptitude Training = 2Hrs
Hours for Communication and Personality Development = 2 Hrs
Mentor- Mentee / Library = 1Hr
Seminar – 1Hr

SEMESTER VI

S. No	Course Code	Category	Course Title	Contact Hours	L	T	P	C	Exam Hrs
THEORY									
1	232NA1A64Q	Professional Core	Design of Offshore Structures	**4**	**3**	**1**	**0**	**4**	**3**
2	232NA1A64R	Professional Core	Ship Motion and Control	**3**	**3**	**0**	**0**	**3**	**3**
3	232NA1A64S	Professional Core	Ship Design	**3**	**3**	**0**	**0**	**3**	**3**
5	232NA1A65H	Professional Elective	PEC 3	**3**	**3**	**0**	**0**	**3**	**3**
6		Open Elective	Online Course 3	**-**	**-**	**-**	**-**	**3**	**3**
7	232NA1A69F	Industry Connect Program	VAC 6	**30Hrs**					
PRACTICALS									
8	232NA1A64T	Professional Core	Marine Hydrodynamics Lab	**2**	**0**	**0**	**2**	**1**	**3**
9	232NA1A64U	Professional Core	Offshore Structure Design Lab	**2**	**0**	**0**	**2**	**1**	**3**
10	232NA1A64V	Professional Core	Ship System Drawing Lab	**2**	**0**	**0**	**2**	**1**	**3**
11	232NA1A67PB		Design Project - II	**4**	**0**	**0**	**3**	**2**	**3**
TOTAL				**23**	**12**	**1**	**9**	**21**	**-**

***L- Lecture; T-Tutorial; P-Practical; C-Credit**

Total Hours Available = **5x7 = 35 Hrs**
Total Hours for regular courses = 27 Hrs (15 Hrs Lec + 3 Hrs Tut + 9 Hrs Pra)
Hours for Placement Training = 2Hrs
Hours for Aptitude Training = 2Hrs
Hours for Communication and Personality Development = 2 Hrs
Mentor- Mentee / Library = 1Hr
Seminar – 1Hr

SEMESTER VII

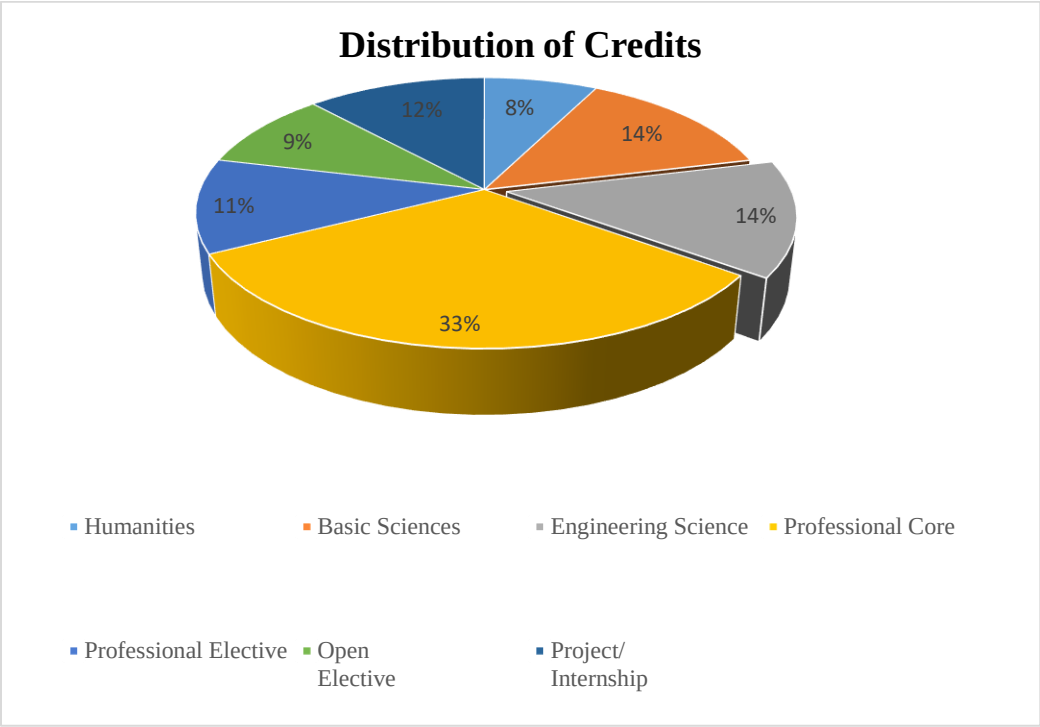
S. No	CourseCode	Category	Course Title	Contact Hours	L	T	P	C	Exam Hrs
THEORY									
1		Humanities and Social Science	Professional Ethics and Human Values	**3**	**3**	**0**	**0**	**3**	**3**
2	233MG1AX2TI	Humanities and Social Science	Entrepreneurship and Startups	**3**	**3**	**0**	**0**	**3**	**3**
3		Open Elective	Online Course 4	**0**	**-**	**-**	**-**	**3**	**-**
4	238LA1A78G	Mandatory	Paper Publication	**0**	**0**	**0**	**0**	**0**	**-**
PRACTICALS									
5		Professional Core	Numerical Ship Hydrodynamics Lab	**2**	**0**	**0**	**2**	**1**	**3**
TOTAL				**8**	**6**	**0**	**2**	**10**	-

SEMESTER VIII

S. No	CourseCode	Category	Course Title	Contact Hours	L	T	P	C	Exam Hrs
1	232NA1A87PC	Project	Project - III	**20**	**0**	**0**	**20**	**10**	**3**
2	238LA1A88G	Mandatory	Paper Publication	**0**	**0**	**0**	**0**	**0**	-
3	232NA1A77C		Internship 3	**-**	**-**	**-**	**-**	**3**	**1**
TOTAL				**20**	**0**	**0**	**20**	**13**	-

Distribution of Credits

As per	Humanities	Basic Sciences	Engineering Science	Professional Core	Professional Elective	Open Elective	Project/ Internship	Total
AICTE	12	25	24	48	18	18	15	160
AMET (Proposed)	12 - 15	20 - 25	20 - 25	50 - 60	15 - 18	12 - 15	12 - 20	160



Open Elective Courses

1. Open elective courses should be offered through online platforms like MOOCs, UGC-SWAYAM, NPTEL, Coursera, Udemy, Spoken Tutorial, Spring Board(Infosis) .etc
2. Students can earn the maximum of 15 credits during their Course of Study.
3. The Credit transfer can be availed based on the submission of certificate for the successful completion of online courses.

Projects

1. Three projects are to be offered in semester 4, 6 and 7 for a total of 14 credits.
2. Mini Project/Design Project – I should be offered in 4th semester which carries 2 credits. The student can fabricate a working model, prototype, products or carry out a simulation work based on the courses studied till 4th semester.
3. Mini Project/Design Project – II should be offered in 6th semester which carries 2 credits. The student can fabricate a working model, prototype, products or carry out a simulation work based on the courses studied till 6th semester
4. Main project should be offered in 7th semester which carries 10 credits. The project can be executed as either an Industrial project or In-house project.
5. The main project shall be implemented and evaluated by following the guidelines given in the AMET regulation 2023-24.

Value Added Courses

The Value added courses (Job oriented Skill based courses) shall be identified based on the global needs beyond the curriculum to facilitate the students for reskilling and Upskilling. These courses shall be offered in two different modes namely In-house and in association with Industries. Based upon the student's performance in assessment, A, B, C grading should be given to them, with A being the highest grade and C being the lowest grade.

In-house

1. Value added courses (Job oriented Skill based courses) should be offered in semesters 1, 3 and 5 by the faculty of in-house departments within the university. Certification for the courses should be given by the offering department of the university.
2. It should be 80% practical based and 20% theory based with a total duration of 35 to 55 hours. Final Assessment needs to be carried out for 50 marks.

In association with Industries

1. Value added courses (Job oriented Skill based courses) should be offered in semesters 2, 4 and 6 by an industry in due MoU of the respective department. The Certificate will be issued jointly by the Industry and AMET University.

Internship

1. Internship – I shall be carried out by the end of first year for a minimum duration of 15 days.
2. Internship – II shall be carried out by the end of second year for a minimum duration of 15 days.
3. Internship – III shall be carried out by 8th semester. The minimum duration is one month and maximum duration is three months for Internship-III.
4. After completing the internship, students should submit a certificate from industry, a internship report and make a presentation for the same for assessment.
5. Based upon the student's performance in assessment, A, B, C grading should be given to them, with A being the highest grade and C being the lowest grade.

PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code	Course Name	L	T	P	C
236PH1A11TA	ENGINEERING PHYSICS	3	0	0	3
Year and Semester	I and I	Contact hours per week (3Hrs)			
Prerequisite course	Nil				

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

Course Objectives

1. To understand the basic postulates of quantum mechanics
2. To understand the concept of atomic spectroscopy.
3. To demonstrate the laser principle, mechanism, and applications
4. To understand applications of photonics
5. To analyze various application of nanotechnology

Course Outcomes

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

1. Summarize the postulates of quantum mechanics
2. Explain the concept of atomic spectroscopy.
3. Describe the construction and working laser and application
4. Explain the applications of nanotechnology
5. Demonstrate the applications of photonics
6. To apply knowledge of quantum physics in nanotechnology and photonics

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	-	-	-	-	-	2	2	2	3
CO2	2	2	2	2	2	-	-	-	-	-	-	2	2	3	3
CO3	2	2	2	1	2	-	-	-	-	-	-	-	2	1	1
CO4	2	2	2	1	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
Avg.	2.3	2.2	2.2	1.7	2.3							2.2	2.0	2.3	2.2

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

UNIT - I Quantum Physics **9 Hrs**

Introduction, Black body radiation, Photoelectric effect, Compton effect, Matter waves, De-Broglie wavelength, Schrodinger wave equations (Time-Dependent & Time-Independent), Probability density, Heisenberg uncertainty principle, Particle in one dimensional box,

Electron Microscope, ***Scanning Electron microscope (SEM)**, Transmission Electron microscope (TEM).

UNIT - II Atomic Physics **9 Hrs**

Introduction, Origin of line spectra, Atomic spectra, Spectral series, Bohr Atomic model - Correspondence principle, Energy levels and spectra, Atomic excitation, Quantum numbers, Radiative transitions, Selection rules, Electron spin, Rotational spectra, Diatomic molecules, Applications - Microwave Spectroscopy, ***Microwave oven.**

UNIT - III Laser and Fiber Optics **9 Hrs**

Introduction, Characteristics of Laser, Einstein's Coefficient A and B, Types of Laser, Nd:YAG and CO_2 laser. *Applications of lasers. Optical Fiber, Propagation and Principle, Types, various modes of optical fiber, Numeric Aperture and Accept Angle, losses in optical fiber, Sensors - Active and Passive Sensors, ***Applications of Optical fiber**

UNIT - IV Photonics **9 Hrs**

Interference, Determination of wavelength by using Michelson interferometer, Determination of thickness of a thin film using Air-wedge, Determination of radius of curvature of a lens using Newton's Rings, Diffraction, Determination of wavelength using Diffraction grating, Holography- Recording and Reconstruction, ***Types of Holograms**, Applications of Holography.

Unit - V Nanotechnology **9 Hrs**

Introduction, origin of nanotechnology, Nanomaterials, Basic principles of nanomaterials, size dependent properties of nanomaterials, fabrication methods of Nanomaterials – Ball milling method, Electro-spinning, Applications of nanomaterials- Solar cells, Quantum dot Light emitting diodes and Quantum dot Laser, Carbon nanotubes, ***Properties and applications of carbon nanotubes,** Toxicity and Sustainability.

TOTAL : 45 Hours

TEXTBOOKS

1. Introduction to quantum mechanics, David J. Griffiths, Pearson Education, Cambridge University Press, 2018.
2. A textbook of quantum mechanics, P M Mathews & K Venkatesan, Tata McGraw-Hill Education, 1978
3. Quantum computing for everyone, Chris Bernhardt, The MIT Press, Cambridge, 2020.
4. MK Verma, Introduction to mechanics, CRC Press, 1st ed., U.S, 1-356, 2009.
5. SH Crandall, NC Dahl & TJ Lardner, An introduction to the mechanics of solids with SI Units,
   McGRaw Hill, 2nd ed., New Delhi, 1- 628, 1978.
6. D. A. Neamen, Semiconductor physics and devices, McGraw-Hill Education, 3rded., UK,1-566, 1997.
7. P. Mani, Engineering physics-II, Dhanam Publications, 1st ed., Chennai, 2015.
8. O. Svelto, Principles of lasers, Springer Science & Business Media, 5th ed., 1-620, 2010.
9. Ajoy Ghatak, Introduction to fiber optics, Cambridge University Press, 1998 ed., Bengaluru, 1-584, 2002.

REFERENCES

1. R Feynmann, R Leighton, M Sands, The Feynmann Lectures on Physics, Volume 1,2,3, Pearson Education; 1st ed., New Delhi, 1-560, 2012.
2. Advanced Visual Quantum Mechanics, Bernd Thaller, Springer International Edition, 2011.
3. Quantum Computing and Quantum Information, Michael A Nelson and Issac L Chaung, Cambridge University Press, 2010
4. D Halliday, R Resenic and J Walker, Fundamentals of Physics, Wiley India Pvt Ltd, 6th ed., New Delhi, 1-1216, 2006.
5. A Ghatak, Optics, McGraw-Hill Education, 1st ed., New Delhi, 1-560, 2009.
6. Ghatak and Thyagarajan, Laser Fundamentals and Applications, Springer, Germany, 2011.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
236PH1A11PA	**ENGINEERING PHYSICS LABORATORY**	0	0	2	1
Year and Semester	I and I	**Contact hours per week** (2 Hrs)			

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Prerequisite course				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
	✓			
Course Objectives	1. To apprehend the effect of torsional stress in ship structures. 2. To understand the effect of bending moments in ships structures. 3. To explain about viscosity and surface tension. 4. To understand the magnetic effect of coil. 5. To explain about interference pattern and formation of air wedge.			
Course Outcomes	After completion of the course, the students will be able to 1. Interpret and validate the measured parameters. 2. Apply the basic concepts of physics to find the stress and strain in materials 3. Justify the values of horizontal magnetic field of earth 4. Determine the viscosity and surface tension of liquids 5. Use of screw guage, vernier calipher and travelling microscope			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	-	-	-	-	-	2	2	2	3
CO2	2	2	2	2	2	-	-	-	-	-	-	2	2	3	3
CO3	2	2	2	1	2	-	-	-	-	-	-	-	2	1	1
CO4	2	2	2	1	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
Avg.	2.3	2.2	2.2	1.7	2.3							2.2	2.0	2.3	2.2

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

Course contents:

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

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10. Uniform bending - Young's modulus of elasticity of a bar

TOTAL: 30 Hrs

TEXTBOOKS

1. D.S. Mathur, P.S.Hemne, 2000, Mechanics, S. Chand & Company Ltd, New Edition, New Delhi, 1-848
2. Ghatak, 2017, Optics, McGraw Hill Education, 6th Edition, New Delhi, 1-632.
3. R. Murugesan, Electricity & Magnetism, 2017, S. Chand & company Ltd, 10th edition, New Delhi, 1-478.
4. H.S. Hans, S.P. Puri, 2009, Mechanics, Tata McGraw Hill Publishing Company Ltd, 2nd edition, New Delhi, 1-551.

REFERENCES

1. M. Narayanamurthi and N. Lakshminarayan, 1997, Electricity and Magnetism, The National Publishing Company, 3rd edition.
2. Hugh D. Young and Roger A. Freedman, 2011, Sears and Zemansky's University Physics: Electricity and Magnetism, Vol- II, Pearson Education Limited, 12th edition, Chennai, Delhi, 1-452.
3. Halliday, Resnick and Walker, 2009, Fundamentals of Physics, Wiley India, extended 8th edition, New Delhi, 1-1279.
4. Brijlal & Subramanian, 2001, Principles of Physics, S. Chand & company Ltd, revised edition.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C
236MA1A11TA	**CALCULUS AND LINEAR ALGEBRA**	**3**	**1**	**0**	**4**
Year and Semester	I and I	**Contact hours per week** (4Hrs)			
Prerequisite course					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
	✓				
Course Objectives	1. To develop the use of matrix algebra techniques for practical applications.				

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	2. To describe the expansion of function and concept of Maxima and Minima for any kind of curve 3. To introduce the functions of several variables 4. To acquaint the student with the concepts of vector calculus needed for problems in engineering discipline. 5. To introduce the concepts of improper integrals, double and triple integral.
Course Outcomes	After completion of the course, the students will be able to 1. Apply the theorems of matrices to solve linear equations. 2. Apply the theorems and formulae for solving problems in differential calculus. 3. Classify the functions of several variables. 4. Solve problems using vector calculus. 5. Apply integral calculus on engineering problems 6. Apply the concepts of Calculus matrices for engineering applications

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO6	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
Avg.	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-

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

UNIT – I Matrices **12 Hrs**

Orthogonal matrices–Eigen values and Eigen vectors–Diagonalization of matrices by Orthogonal transformation. -Application of Cayley-Hamilton theorem-Introduction to vector space –Linear combinations- Basis and dimension.

UNIT – II Differential Calculus **12 Hrs**

Successive differentiation–n^{th} derivative–Problems Leibnitz theorem– Indeterminate forms - Hospital's rule–Taylor's and McLaurin theorem with remainders–Maxima and minima and its application.

UNIT – III Multivariable Calculus : **12 Hrs**

Partial derivatives–Directional derivatives–Total derivative–Tangent plane and normal line–Maxima and minima of functions of two variable–Method of Lagrange multipliers.

UNIT – IV Vector Calculus **12 Hrs**

Vector differential operators - Gradient – Divergence and Curl – Directional derivative – Irrotational and solenoidal– Vector integration –Application of Green's theorem in a plane – Gauss divergence theorem and stoke's theorem – Simple applications involving cubes and rectangular parallelepipeds.

UNIT – V Integral Calculus **12 Hrs**

Definite and indefinite integrals –Substitution rule–Integration by parts–Trigonometric substitutions– Improper integrals–Beta and Gamma functions and their simple properties– Double integrals– Area enclosed by plane curves–Triple integrals– Volume of solids–Change of variables in double and triple integrals.

Total: 60 Hrs

TEXTBOOKS

1. T.Veerarajan, Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2016.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2016.

REFERENCES

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.V Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11th2010.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code **236CH1A11TA**	**Course Name** **ENGINEERING CHEMISTRY**	L	T	P	C
		3	**0**	**0**	**3**
Year and Semester	I and II	**Contact hours per week** (4 Hrs)			
Prerequisite course					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

	Basic Science	Engineering Science	Open Elective	Mandatory
	✓			

Course Objectives	1. Learn the problems associated water treatment methods and boiler water chemistry 2. Understand the concept of corrosion and its control 3. Classify the types of materials and their applications
Course Outcomes	After completion of the course, the students will be able to 1. Understand the water technology and its treatment importance 2. Appraise the boiler chemistry in its protection 3. Identify the problems associated with corrosion with its control measures 4. Understand the materials, necessity and its utilization 5. Recognize the need of green chemistry for future 6. Utilize the knowledge of engineering science

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	2	-	-	-	-	2	1	2	3
CO2	2	2	-	-	-	-	3	-	-	-	-	2	2	2	2
CO3	2	2	-	-	-	-	3	-	-	-	-	2	-	-	-
CO4	2	2	-	-	-	-	3	-	-	-	-	2	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	2	-	-	-
CO6	3	2	3	-	2	-	3	-	-	-	-	2	2	2	2
Avg.	2.3	2	3	-	2	-	2.8	-	-	-	-	2	2	2	3

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

UNIT - I WATER TECHNOLOGY **9 Hrs**

Water and it's impurities - Significance and estimation – hardness, turbidity, colour, pH, acidity, solids, chlorides, residual chlorine, sulphates, fluorides, phosphates, iron and manganese - DO, BOD, COD, oil and grease, salinometer and use of coagulants.Domestic Water treatment - Purification – Sterilization and disinfection: UV treatment- Ozone treatment-Chlorination, Break point chlorination

UNIT - II WATER TREATMENT **9 Hrs**

Introduction to boiler feed water- Requirements of boiler feed water- Purpose of water treatment in boilers, scale and sludge formation and prevention, priming and foaming-chemical and mechanical deareation – condensate water chemistry – super heated steam and its quality - methods of chemical and mechanical deareation – Boiler treatment methods.Zeolite process and ion exchange (demineralization) - caustic soda treatment - condensate lime treatment - Desalination of water - reverse osmosis and electrodialysis.

UNIT - III CORROSION AND CORROSION CONTROL **9 Hrs**

Corrosion :- Definition – Theories of Corrosion (chemical & electrochemical) – concentration cell corrosion, 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 ENGINEERING MATERIALS **9 Hrs**

Introduction, Types, examples of particulate (metal/metal oxide), tubular/fibre (CNT/CNF), layered (Nanoclays, Graphene Oxide) and its properties. Preparation of nanomaterials – Top down (Ball milling, CVD) and Bottom up (Self-assembly, sol–gel) - characterization of nanomaterials.Lubricants – properties of lubricants – Paint – white paint - Coating - Additives – epoxy coating – high temperature resistant coating – rubber line coating.

UNIT - V FUEL & ENERGY SOURCES **9 Hrs**

Fuels – Introduction – Classification – Calorific value - HCV and LCV – Solid Fuel, Coal — Proximate and ultimate analysis – Significance of the analyses – Liquid fuels – Petroleum oil - Refining – Cracking – Petrol and Diesel knocking - Octane and Cetane ratings – Anti-knock agents - Biofuels - Bio-diesel and bio-ethanol – Gaseous fuel, Natural gas, LPG and CNG – Primary and secondary batteries - alkaline batteries – lead acid, Ni – Cd and Li ion batteries, Sodium and Zinc based batteries- Solar cell and Fuel cell.

Total: 45 Hrs

TEXTBOOKS

1. A Textbook of Engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
2. Engineering Chemistry by Jain and Jain, 17th Edition, Dhanpat Rai Publishing Company, New Delhi, 2021.
3. Milton and Leech, “Marine Boilers”, Butter Worth Publishers, UK
4. Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, 2021

REFERENCES

Document Prepared in “Board of studies” held on Date:19.07.2023	Document Approved in “Academic council” held on Date:22.11.2023

1. L. Jackson and T.D. Morton, "Reed's General Engineering Knowledge for Marine Engineers", Vol. 8, 2020.

2. Vairam S., Murugavel S.C. and Chelladurai C, "Engineering Chemsitry-I & II", Gems Publishers, 2021.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C
236CH1A11PA	**ENGINEERING CHEMISTRY LABORATORY**	**0**	**0**	**2**	**1**
Year and Semester	I and II	**Contact hours per week** (4 Hrs)			
Prerequisite course					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
	✓				
Course Objectives	1. To analyze the given water sample to determine its alkalinity and hardness. 2. To quantitatively estimate the given solutions using instruments like potentiometer, conductivity meter and pH meter and Viscometer				
Course Outcomes	After completion of the course, the students will be able to 1. Analyze the alkalinity of give water samples. 2. Estimate the hardness of water 3. Compare the acid strengths of given acids using conductivity meter 4. Determine the strength of acid using pH meter 5. Estimate the amount of ferrous iron in given solution potentiometrically 6. Determine the viscosity of given polymer using viscometer				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	2	-	-	-	-	-	-	3	3	2
CO2	2	3	2	2	1	2	-	-	-	-	-	-	2	3	2
CO3	3	3	1	2	2	1	-	-	-	-	-	-	3	3	1
CO4	3	3	1	2	2	2	-	-	-	-	-	-	3	3	1
CO5	3	3	2	2	1	2	-	-	-	-	-	-	3	3	2
CO6	2.8	3	1.6	1.8	1.6	1.8	-	-	-	-	-	-	2.8	3	1.6
Avg.	3	3	2	1	2	2	-	-	-	-	-	-	3	3	2
CORRELATION LEVELS		1. SLIGHT (LOW)			2. MODERATE (MEDIUM)					3. SUBSTANTIAL (HIGH)					

List of Experiments

1. Estimation of Hydroxide Alkalinity
2. Estimation of Bicarbonate Alkalinity
3. Estimation of Temporary, Permanent and Total Hardness
4. Determination of strength of given hydrochloric acid using pH meter.
5. Conductometric titration of strong acid vs strong base.
6. Determination of strength of acids in a mixture of acids using conductivity meter.
7. Estimation of iron content of the given solution using potentiometer.
8. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
9. Corrosion experiment ─ weight loss method.
10. Pseudo first order kinetics ─ ester hydrolysis.

REFERENCES

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, (2001).
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore (1994).
3. Jeffery G.H., Bassett J., Mendham J. and Denny "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980

PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code 236MA1A21TB	Course Name TRANSFORMS AND DIFFERENTIAL EQUATIONS	L 3	T 1	P 0	C 4
Year and Semester	I and II	Contact hours per week (4 Hrs)			
Prerequisite course					

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

Course Objectives

1. To evaluate the complex problems by using Laplace transform.
2. To impart the knowledge of fourier transform and Z-transform techniques
3. To exintroduce the concepts of Fourier series in engineering.
4. To provide the required knowledge to solve first order DE.
5. To provide the required knowledge to solve second order PDE.

Course Outcomes

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

1. Interpret the use of Laplace transforms in the engineering field.
2. Determine Fourier transform and Z transform of a function.
3. Interpret Fourier series method and its applications.
4. Interpret the first order differential equations
5. Apply the concept of ordinary differential equations and transforms on different techniques.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	-	3	3	-	2
CO2	3	3	-	2	-	-	-	-	-	-	-	3	3	-	2
CO3	3	3	-	2	-	-	-	-	-	-	-	3	3	-	2
CO4	3	3	-	2	-	-	-	-	-	-	-	3	3	-	2
CO5	3	3	-	2	-	-	-	-	-	-	-	3	3	-	2
CO6	3	3	-	2	-	-	-	-	-	-	-	3	3	-	2
Avg.	3	3	-	2	-	-	-	-	-	-	-	3	3	-	2

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

UNIT- I Laplace Transform **12 Hrs**

Laplace transform – Conditions for existence – Transforms of elementary functions — Transform of periodic functions - Inverse Laplace transforms –Application of convolution

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theorem – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT- II Fourier Transforms & Z Transforms **12 Hrs**

Fourier Transform-Properties of Fourier transform- Fourier sine and cosine transforms – Application of Convolution theorem -Standard Z-transforms- Standard results - Properties of Z- transform -Initial value and Final value theorem- Inverse Z-transform.

UNIT- III Fourier Series **12 Hrs**

General Fourier series – Odd and even functions– Half range sine series – Half range cosine series – Complex form of Fourier series – Harmonic analysis.

UNIT- IV Ordinary Differential Equations **12 Hrs**

Equations solvable for p – Equations solvable for y – Equations solvable for x and Clairaut's type. Second order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy-Euler equation.

UNIT-V First and Higher order Partial Differential Equations **12 Hrs**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions- Lagrange's Linear First order equation- Classification of PDE – Method of separation of variables – Solutions of one-dimensional wave equation and heat equation.

Total:60 Hrs

TEXTBOOKS

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2016.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2016.

REFERENCES

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,
2. Reprint, 2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons 2006.
4. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary
5. Value Problems, 9th Edn., Wiley India, 2009.
6. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall

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India, 1995.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code **236MA1A41TD**	**Course Name** **MATHEMATICAL FOUNDATION FOR ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**	L	T	P	C
		2	**1**	**0**	**3**
Year and Semester	II and III	**Contact hours per week** (3 Hrs)			
Prerequisite course					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
	✓				
Course Objectives	1. To conceptualize the basic ideas and techniques underlying the design of intelligent systems. 2. To understand the basic principles of probability and use it for problem solving. 3. To provide the basic knowledge of random varibale and distributions., 4. To understand the concepts of Markov process. 5. To demonstrate Markov chain and its applications.				
Course Outcomes	After completion of the course, the students will be able to 1. Identify and define data-oriented problems in real life. 2. Solve problems using probability concepts. 3. Apply the random variable concepts and distributions. 4. Classify the states of a Markov process and study the uses. 5. Describe a Markov chain and its transition matrix. 6. Demonstrate understanding of basic mathematical concepts in data science, AI, relating to probability and statistics.				

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

UNIT – I Introduction **9 Hrs**

Introduction to Data Science and Artificial Intelligence: Role of Mathematics, Vector operations. Vector projection, cosine similarity, orthogonal vectors, normal and orthonormal vectors, vector norm, vector space, linear combination, linear span, linear independence, basis vectors.

UNIT– II Probability and Statistics **9 Hrs**

Probability, Dependence and Independence, conditional probability, Bayes' Theorem, Random variables- continuous and discrete, expectation, variance, joint and conditional distributions.

UNIT – III Distributions **9 Hrs**

Continuous distribution: Normal distribution, Exponential distribution, Gamma distribution and Geometric distribution - Central limit theorem- applications.

UNIT – IV Markov Process **9 Hrs**

The Markov property. Chapman-Kolmogorov's relation, classification of Markov processes and transition probability. Transition intensity, forward and backward equations. Stationary and asymptotic distribution. Convergence of Markov chains.

UNIT – V Markov chain and **Monte Carlo** **9 Hrs**

preliminaries: The canonical ensemble and the two-dimensional Using model , lattice labeling, sampling and re-weighting , importance sampling , the Metropolis algorithm , the heath bath algorithm - illustrations of Monte Carlo simulations I: discrete systems.

Total: 45 Hrs

TEXTBOOKS

1. Basics of Linear Algebra for Machine Learning, Jason Brownlee, Edition: v1.1.

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2. Probability for Statistics and Machine Learning: Fundamentals and Advanced Topics (Springer Texts in Statistics)
3. Bendat, J.S and A.G Piersol (2010) Random data: data Analysis and Measurements Procedures.4th Edition John Wiley & sons Inc., NY, USA.

REFERENCES

1. R Cathy O'Neil and Rachel Schutt, Statistics for Machine Learning: Techniques for exploring supervised, unsupervised and reinforcement learning models with Python and doing Data Science,O'ReillyMedia,2013.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C
236MA1A31TC	**PROBABILITY AND STATISTICS**	**3**	**1**	**0**	**4**
Year and Semester	II and IV	**Contact hours per week** (4 Hrs)			
Prerequisite course					

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

Course Objectives	1. To acquire skills about one random variables. 2. To acquire skills about two random variables. 3. To discuss sampling techniques and hypothesis based on small and large samples. 4. To understand how to classify the graph by Morkov process. 5. To analyze the variance of one way classification and design SQC.
Course Outcomes	After completion of the course, the students will be able to 1. Distinguish one dimensional random variables and some standard distributions. 2. Be familiar with two dimensional random variables and its relation among them.

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	3. Know this statistical methods which are applied especially in the realm of scientific experiments and the testing of hypothesis. 4. Construct the Morkov model for Hidden statistics. 5. Apply the Procedures for statistical quality control. 6. Infer the output from statistical analysis

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
CO6	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-
Avg.	3	3	-	2	-	-	-	-	-	-	-	2	3	3	-

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.

General Fourier series – Odd and even functions– Half range sine series – Half range cosine series – Complex form of Fourier series – Harmonic analysis.

UNIT- IV Markov Process & Markov Chain **12 Hrs**

Markov process, Classification of Markov process, States of a Markov process- applications. Markov chain, Bayesian Networks, Hidden Markov Models- applications

UNIT-V Design of Experiments & Statistical Quality Control **12 Hrs**

Analysis of variance – One way classification – Completely randomized design – Two way classifications- Randomized Block design -Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np Charts) – Tolerance limits - Acceptance sampling **Total: 60 Hrs**

TEXTBOOKS

1. J. S. Milton and J.C. Arnold, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th edition, 2007. (For units 1 and 2).
2. B.S, Grewal "Higher Engineering Mathematics", 40thEdition, Khanna Publications, Delhi, 2007.

REFERENCES

1. R. E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye, "Probability and Statistics
2. for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002
3. W. Navidi,"Statistics for Engineers and Scientists", Special Indian Edition, Tata
4. McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
5. M.R. Spiegel, J. Schiller and R. Alu Srinivasan R, "Schaum"s Outlines
6. Probability and Statistics", Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2007.
7. R.A. Johnson and C.B. Gupta, "Miller and Freund"s Probability and Statistics for
8. Engineers", Pearson Education, Asia, 7th edition, (2007)

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**			L	T	P	C
236EN1A12TA	**TECHNICAL ENGLISH**			**2**	**0**	**0**	**2**
Year and Semester	**I and I**		**Contact hours per week** (2Hrs)				
Prerequisite course	Nil						
Course category	**Humanities and Social Sciences Management courses**		**Professional Core**	**Professional Elective**		
	✓					
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**		
Course Objectives	1. To improve reading skills of students in different types of texts 2. To enhance their communicative skills in real life situations.					

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	3. To help learners passionately improve their vocabulary. 4. To enable learners develop their listening skills. 5. To develop students professional writing skills.
Course Outcomes	After completion of the course, the students will be able to 1. Develop good reading and writing skills 2. Outline the importance of technical English in reading and writing with proper tense and prepositions 3. Identify common errors in tenses and sentences 4. Demonstrate reading and writing skills for effective presentation. 5. Acquire good reading, writing and listening skills 6. Apply the correct pause and pronunciation competence necessarily required in various life situation.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	-	3	3	-	3	-	-	-
CO2	-	-	-	-	-	3	3	-	2	2	-	3	-	-	-
CO3	-	-	-	-	-	2	2	-	2	2	-	2	-	-	-
CO4	-	-	-	-	-	2	2	-	3	3	-	3	-	-	-
CO5	-	-	-	-	-	2	2	-	3	3	-	3	-	-	-
CO6	-	-	-	-	-	3	3	-	3	3	-	3	-	-	-
Avg.						2.5	2.5		2.7	2.7		2.8			

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

UNIT I **6 Hrs**

Reading – The Sea Devil by Arthur Gordon – Comprehension. **Writing**: Email, email etiquette, **Speaking**: Introducing oneself. **Grammar**: Parts of speech - Present Tenses. **Vocabulary**: Technical Vocabulary for specific purposes, SWOT Analysis

UNIT II **6 Hrs**

Reading: A Saucer of Loneliness by Theodore Sturgeon, Reading for Comprehension. **Writing:** Gadget review. **Listening:** Identifying main and secondary Points. **Speaking:** Asking questions. **Grammar:** Past Tenses - WH/Yes or No Questions. **Vocabulary:** Idiomatic expressions.

Unit III: **6 Hrs**

Reading: Ballad of the Long-Legged Bait, Dylan Thomas – Scanning. **Writing:** Paragraph writing. **Listening:** Taking notes from a discussion. **Speaking:** Narrating an incident. **Grammar:** Future Tenses - Prepositions. **Vocabulary:** Prefixes and Suffixes.

UNIT IV **6 Hrs**

Reading: The Blue Jar by Isak Dinesen – Skimming. **Writing:** Description. **Listening:** Listening for specific information and identifying parts from a description. **Speaking:** Small

talk. **Grammar**: Articles and Direct speech and Indirect Speech. **Vocabulary:** One-word substitutions

UNIT V **6 Hrs**

Reading: Going to Sea Inspirational Story by James Baldwin **Writing:** Process descriptions. **Listening:** Listening to a documentary and making notes. **Speaking:** Expressing preferences. **Grammar:** Conjunctions and Active voice and Passive voice; **Vocabulary:** Homonyms and homophones.

TOTAL : 30 PERIODS

TEXTBOOKS

1. Sudharshana.N.P and Saveetha C. (2016) English for Technical Communication. Cambridge University Press: New Delhi.

REFERENCES

1. Practical English Usage – Michael Swan. Oxford University Press, 1980.
2. Board of Editors, Mindscapes: English for Technologists & Engineers, Chennai: Orient Blackswan.
3. S.P.Dhanavel, English and Communication Skills, Chennai: Orient Blackswan, 2010.
4. Essential Grammar in Use- Raymond Murphy, London: Cambridge, 2007.

<table>
<tr><td>PROGRAM</td><td colspan="6">B.E.-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
236EN1A12PX</td><td colspan="3">Course Name
COMMUNICATION SKILLS LABORATORY-I</td><td>L
0</td><td>T
0</td><td>P
2</td><td>C
1</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I and I</td><td colspan="4" rowspan="2">Contact hours per week
(2Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2"></td></tr>
<tr><td rowspan="4">Course category</td><td colspan="2">Humanities and Social Sciences Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td colspan="2">✓</td><td></td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objectives</td><td colspan="6">1. To listen conversation and motivational speeches.
2. To enable students speaking effectively in real life situations and soft skills.
3. To equip them with employability skills to enhance their prospect of placements</td></tr>
</table>

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Course Outcomes	After completion of the course, the students will be able to 1. Communicate with others in practical, business-oriented situations 2. Identify the proper tone of language required in writing and speaking in business communication 3. Relate between letters and memos and various forms of Business Communication 4. Display knowledge on grammar and other linguistic features in writing various forms of business communication 5. Write business reports, minutes, proposals etc., 6. Present the report and memos in front of an audience.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	2	3	3	-	3	-	-	-
CO2	-	-	-	-	-	2	2	2	3	3	-	3	-	-	-
CO3	-	-	-	-	-	3	2	2	3	3	-	3	-	-	-
CO4	-	-	-	-	-	2	2	2	3	3	-	3	-	-	-
CO5	-	-	-	-	-	3	2	2	3	3	-	3	-	-	-
CO6	-	-	-	-	-	2	2	2	3	3	-	3	-	-	-
Avg.						2.5	2.0	2.0	3.0	3.0		3.0			

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

Unit I Fundamentals of Communication

Communication Cycle, Levels of communication; Flow of communication; Communication networks; General and Technical Communication.

Unit II Listening and Speaking

Types of listening - Listening to lectures, dialogues from TV/radio/Podcast – motivational speeches – Self-introduction - JAM

Unit III Reading and Technical Writing Skills

Reading Comprehension tests ranging from magazine and newspapers – strategies of reading – summarize a text – Writing job applications – Cover letter – Resume

Unit IV Soft Skills

Human values – intercultural communication – learning strategies – lateral thinking - Motivation - career planning

Unit V Interview Skills

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- FAQ- Online Interview- Panel Interview -Video samples.

TOTAL : 30 PERIODS

REFERENCES

1. Business English Certificate Materials, Cambridge University Press
2. Communication Skills. Sanjay Kumar and Pushpa Latha, Oxford University Press, 2011
3. Exercises in Spoken English Part – I – III, Hyderabad, Oxford University Press.
4. http://www.oxforddictionaries.com/words/writing-job-applications
5. **Software**
6. OREL

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code **233MG1AX2T**	**Course Name** **UNIVERSAL HUMAN VALUES-2 UNDERSTANDING HARMONY**	L	T	P	C
		2	**1**	**0**	**3**
Year and Semester	**I and II**	**Contact hours per week**			
Prerequisite course		(Hrs)			
Course category	**Humanities and Social Sciences Management courses**		**Professional Core**		**Professional Elective**
	✓				
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**
Course Objectives	1. Development of a holistic perspective based on self- exploration about themselves (humanbeing), family, society and nature/existence. 2. Understanding (or developing clarity) of the harmony in the human being, family, society andnature/existence 3. Strengthening of self-reflection. 4. Development of commitment and courage to act. 5. Implications of the above Holistic Understanding of Harmony on Professional				

	Ethics.
Course Outcomes	After completion of the course, the students will be able to 1. Understand the perspective based on self- exploration. 2. Gain knowledge on harmony in the human being, family, society and nature/existence 3. Learn the principles and practice of Strengthening of self-reflection 4. Understand the development of commitment and courage to act. 5. Gain knowledge on Holistic Understanding of Harmony on Professional Ethics. 6. Apply the Human Values in real life

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-					1	-		-	-	-	3	-	-	-
CO2	-	-	-	-	-	3	-		-	-	-	3	-	-	-
CO3	-	-	-	-	-	3	-		-	-	-	3	-	-	-
CO4	-	-	-	-	-	3	-		-	-	-	3	-	-	-
CO5	-	-	-	-	-	3	-	3	-	-	-	3	-	-	-
CO6	-	-	-	-	-	3	-		-	-	-	3	-	-	-
Avg.	-	-	-	-	-	2.87	-	3	-	-	-	3	-	-	-

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

Unit 1: Course Introduction-Need, Basic Guidelines, Content and Process for Value Education **9 hours**

1. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.
2. Continuous Happiness and Prosperity- A look at basic Human Aspirations
3. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
4. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
5. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
   Include practice sessions to discuss natural acceptance in human being as The innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself **9 hours**

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.
2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
4. Understanding the Characteristics and activities of 'I' and harmony in

'I'.

5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
6. Programs to ensure Sanyam and Health.
7. Include practice sessions to discuss the role others have played in Making material goods available tome. Identifying from one's own life.
8. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship 9 hours

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence 3.Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
3. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
4. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
5. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc.
6. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence 9 hour

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation innature.
3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.
4. Holistic perception of harmony at all levels of existence.
5. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used),pollution, depletion of resources and role of technology etc.

Unit 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

9 hours

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:
    a. Ability to utilize the professional competence for augmenting universal human order
    b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
    c. Ability to identify and develop appropriate technologies and management patterns for above productionsystems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:
    a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
    b) At the level of society: as mutually enriching institutions and organizations
7. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. to discuss the conduct asan engineer or scientist etc.

TOTAL : 45 HRS

TEXTBOOKS

1. R R Gaur, R Sangal, G P Bagaria ,Human Values and Professional Ethics , Excel Books, New Delhi, 2010.

REFERENCES

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
236EN1AX2PX	**COMMUNICATION SKILLS LABORATORY- II**	**0**	**0**	**2**	**1**

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Year and Semester	**I and I**		**Contact hours per week 2** (Hrs)	
Prerequisite course				
Course category	**Humanities and Social Sciences Management courses**		**Professional Core**	**Professional Elective**
	✓			
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
Course Objectives	1. To make them realize the importance of career development in current scenario. 2. To enhance their communicative skills in real life situations. 3. To help learners participate passionately improve their listening and speaking skills.			
Course Outcomes	After completion of the course, the students will be able to 1. Speak effectively with appropriate competence and performance. 2. Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation. 3. Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings. 4. Use communication strategies to participate in groups. 5. Participate effectively in work place related activities pertained to technical communication.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	2	3	3	-	3	-	-	-
CO2	-	-	-	-	-	2	2	2	3	3	-	3	-	-	-
CO3	-	-	-	-	-	3	2	2	3	3	-	3	-	-	-
CO4	-	-	-	-	-	2	2	2	3	3	-	3	-	-	-
CO5	-	-	-	-	-	3	2	2	3	3	-	3	-	-	-
CO6	-	-	-	-	-	2	2	2	3	3	-	3	-	-	-
Avg.						2.5	2.0	2.0	3.0	3.0		3.0			

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

Unit-I Listening

Listening to Conversation and Speeches by Native Speakers - group discussion and interview skills - Speaking - Describing a simple process - Asking and answering questions.

Unit-II Writing Skills

Writing job applications - cover letter - resume – emails – letters – reports – blogs

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Unit-III Presentation Skills

Presentation skills - Elements of effective presentation – Structure of presentation - Presentation tools - General and Technical topics-Honing Body-language-Extempore

Unit-IV Group Discussions

Why is GD part of selection process? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

Unit-V Interview Skills

Preparation – Punctuality – Professionalism – Communication – Confidence – Showing interest – Follow up

TOTAL : 30 PERIODS

REFERENCES

1. Communication Skills. Sanjay Kumar and Pushpalatha, Oxford University Press, 2011
2. Exercises in Spoken English Part – I – III, Hyderabad, Oxford University Press.
3. http://www.oxforddictionaries.com/words/writing-job-applications

<table>
<tr><td>PROGRAM</td><td colspan="6">B.E.-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
233MG1A32TB</td><td colspan="2">Course Name
TOTAL QUALITY MANAGEMENT</td><td>L
3</td><td>T
0</td><td>P
0</td><td>C
3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">II and III</td><td colspan="4" rowspan="2">Contact hours per week
(3 Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="4">Course category</td><td colspan="2">Humanities and Social Sciences Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td colspan="2">✓</td><td></td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objectives</td><td colspan="6">1. To actively involves every function and every employee in satisfying customers' needs, both internal and external.
2. To create a culture in an organization to involve everybody in quality improvement.</td></tr>
</table>

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Course Outcomes	After completion of the course, the students will be able to 1. Explain the evolution of quality 2. Demonstrate the principles of total quality management 3. Discuss the bench marking tools and techniques of total quality management 4. Summarize the performance evaluation tools of management techniques 5. compare the different ISO standards 6. Apply the TQM tools and techniques for effective monitoring and control oforganization

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	3	2	-	-	-	-	-	-	-
CO3	-	-	-	-	3	3	3	3	2	3	-	-	-	-	-
CO4	-	-	-	-	3	3	2	3	2	-	-	3	-	-	-
CO5	-	-	-	-	-	3	2	3	3	3	-	3	-	-	-
CO6	-	-	-	-	3	3	3	2	3	2	-	3	-	-	-
Avg.	-	-	-	-	3.0	3.0	2.5	2.7	2.5	2.7	-	3	-	-	-

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

UNIT – I INTRODUCTION 9 Hrs

Introduction – Need for quality – Evolution of quality – Definition of quality – Dimensions of manufacturing and service quality – Basic concepts of TQM – Definition of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT – II TQM PRINCIPLES 9 Hrs

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork – Recognition and Reward – Performance appraisal – Continuous process improvement – PDSA cycle, 5s, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT – III TQM TOOLS & TECHNIQUES I 9 Hrs

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types**.**

UNIT – IV TQM TOOLS & TECHNIQUES II 9 Hrs

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM –Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT – V QUALITY SYSTEMS **9 Hrs**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

Total: 45 Hours

TEXTBOOKS

1. Dale H.Besterfield, Carol Besterfield – Michal, Glen H. Besterfield, Mary Besterfield – Sacre, Hermant – Urdhwareshe, RashmiUrdhwareshe, Total Quality Management, 5th edition, Pearson Education, 2018
2. Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, 2nd Edition,2010.

REFERENCES

1. James R. Evans and William M. Lindsay, ―The Management and Control of Quality, 6thEdition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. ―TQM – Text with Cases, Butterworth – Heinemann Ltd., Oxford, 3rd Edition,2003.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name** **PRINCIPLES OF MANAGEMENT**	L **3**	T **0**	P **0**	C **3**
Year and Semester	**II and III**	**Contact hours per week** (3Hrs)			
Prerequisite course	NIL				
	Humanities and Social Sciences Management courses	**Professional Core**		**Professional Elective**	

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Course category	✓			
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	1. To understand the evolution and functions of management 2. To gain knowledge about planning and organizing 3. To know about the directing and controlling 4. To learn about the theories of motivation and leadership 5. To study the importance of organizational behavior
Course Outcomes	After completion of the course, the students will be able to 1. Explain the evolution and functions of management 2. Explain the importance of planning and organizing 3. Examine the directing and controlling process 4. Examine the motivational theories and types of personality 5. Identify the behavioural aspects in an organization 6. Apply the managerial skills in an organization

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	2	2	3	-	3	2	2	3	3	-	-	2	2
CO2	2	2	2	2	3	2	3	2	2	3	3	2	2	2	2
CO3	2	2	2	2	3	2	3	2	2	3	3	2	2	2	2
CO4	-	-	2	2	3	-	3	2	2	3	3	-	-	2	2
CO5	-	-	2	2	3	-	3	2	2	3	3	-	-	2	2
CO6	2	2	2	3	3	2	3	2	2	3	3	2	2	2	3
Avg.	2.00	2.00	2.00	2.17	3.00	2.00	3.00	2.00	2.00	3.00	3.00	2.00	2.00	2.00	2.17

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

UNIT – I NATURE OF MANAGEMENT 9 Hrs

Definition and importance of management, Functions and Process of Management, planning, organizing, staffing, leading and motivating, controlling. Managerial levels, managerial skills. Schools of Management Thought: Scientific Management School, Fayol's Contribution.- Case Study

UNIT– II PLANNING AND ORGANIZING 9 Hrs

Planning Concept, definitions and importance, types of plans, essential features of planning, principles of planning, steps in planning process, barriers in planning – Organizing principles of organization, Formal and informal organization, Line structure, Line and staff structure, Functional structure, Matrix structure, Committees, Authority, responsibility, accountability, delegation of authority, departmentation, decentralization, Span of Control.- Case Study

UNIT – III DIRECTING AND CONTROL 9 Hrs

Directing: General principles of directing, MBO, MBE models. Controlling: Definitions, importance of controlling, types and techniques of control, essentials of good control systems, budgetary and non-budgetary control.

UNIT – 4 MOTIVATION AND LEADERSHIP **9 Hrs**

Definition, Theories-Maslow, Herzberg, McClelland, Vroom's Theory, Equity Theory and Contemporary Theories, Leadership: Concept, Theories, and Styles of Leadership. Theory X and Y styles. Personality of Business and Social leaders

UNIT– V ORGANIZATIONAL BEHAVIOUR **9 Hrs**

Introduction to Organizational Behavior, Definition of Personality, Theories of Personality, Factors influencing Personality – Perception and factors distorting Perception, Johari's window of Self Awareness. Ta.- demonstration (Individual Performance)– use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

Total :45 Hrs

TEXTBOOKS

1. Management - Theory & Practice, C.B. Gupta, Publisher: Sultan Chand & Co (2012)
2. Principles of Management, P.N.Tripathi, Publisher: Tata Mcgraw Hill (2012)

REFERENCES

1. Essentials of management - Koontz and Odonell, Publisher: Tata Mcgraw Hill (2006)
2. Organisational behavior - S.Robins, Publisher: Pearson Education (2018)
3. Organizational behavior - F Luthans, Publisher: Tata Mcgraw Hill (2010)'

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name** **ENTREPRENEURSHIP AND START-UPS**	L **3**	T **0**	P **0**	C **3**
Year and Semester	**II and III**	**Contact hours per week** (3Hrs)			

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

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 fundamentals of entrepreneurship
2. To learn about the process of starting small enterprises
3. To gain knowledge about the project management
4. To understand the sources of finance and its analysis
5. To acquire knowledge on marketing channels

Course Outcomes

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

1. Identify the concepts of entrepreneurship.
2. Identify the process of small business startups.
3. Explain the concepts of project management and Business plan.
4. Examine the financial aspects of projects.
5. Explain the marketing management for business.
6. Apply the entrepreneurial knowledge for startups.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	3	2	2	2	3	2	2	2	2
CO2	3	-	3	3	3	3	3	3	2	3	3	3	-	3	3
CO3	2	-	2	-	2	2	3	2	2	2	3	2	-	2	-
CO4	3	-	-	-	2	-	3	3	2	2	3	3	-	-	-
CO5	2	2	2	-	2	-	3	2	2	2	3	2	2	2	-
CO6	2	2	2	2	2	2	3	2	2	2	3	2	2	2	2
Avg.	2.33	2.00	2.20	2.33	2.17	2.25	3.00	2.33	2.00	2.17	3.00	2.33	2.00	2.20	2.33

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

UNIT 1: ENTREPRENEURSHIP **10 Hrs**

Definitions and Structure, The Entrepreneurial Culture, The Concept of Entrepreneurship, Classification and Types of Entrepreneurs, Entrepreneurial Traits and Motivation, , Entrepreneur Vs. Salaried people

UNIT 2:SETTING UP A SMALL INDUSTRY& PROBLEMS OF EPRENEURSHIP 10 Hrs

Steps for Starting a Small Industry, Selection of Types of Organization, Incentives and Subsidies, Problems of Entrepreneurship, Sickness in Small-scale Industries - Reasons and Remedies, Importance of SME to our Economy

UNIT 3:PROJECT MANAGEMENT AND BUSINESS PLAN FOR NEW VENTURES 9 Hrs

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Concept of Projects and Classification, Project Report, Project Appraisal, Factory location and Layout, Institutions in Aid of Entrepreneurs. Development of Women Entrepreneurs, Meaning and Objectives of a Business Plan, Advantages and cost of preparing a Business Plan, Elements, Critical Assessment

UNIT 4:FINANCIAL ANALYSIS & SOURCES OF FINANCE **9 Hrs**

Financial Appraisal, Break-Even Analysis, Profitability Analysis, Sources of Development Finance, Project Financing, Institutional Finance to Entrepreneurs.

UNIT 5:ENTREPRENEURSHIP DEVELOPMENT AND GOVERNMENT **7 Hrs**

Role of Central Government and State Government in promoting entrepreneurship with various incentives, subsidies, grants, programs, schemes and challenges. Government initiatives and inclusive entrepreneurial Growth.

Total 45 Hours

TEXTBOOKS

1. Vasant Desai ,Dynamics of Entrepreneurial Development and Management, Himalayan Book Company
2. Gupta &Srinivasan, Entrepreneur Development, Pearson publications.

REFERENCES

1. Dr. A.K. Singh, Entrepreneurship Development and Management, Laxmi Publications.
2. S. S. Khanka, Entrepreneurial Development, S. Chand publications.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name** **PROJECT MANAGEMENT**			L **3**	T **0**	P **0**	C **3**
Year and Semester	**II and III**		**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**		

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Course Objectives	1. To outline the need for Project Management 2. To understand the Project Planning & Management 3. To highlight the need for project control 4. To understand the project evaluation 5. To study the role of project management			
Course Outcomes	After completion of the course, the students will be able to 1. Evaluate and select the most desirable projects. 2. Apply appropriate approaches to plan a new project and develop the project schedule 3. Identify the important ways to monitor a new project 4. Understand the guidelines to close a project 5. Evaluate the risk management 6. Students will apply the skills to write a winning project proposal			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO2	3	3	2	2	3	2	3	2	3	3	3	3	3	2	2
CO3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	3	3	2	2	2	2	3	3	2	2	3	3	3	2	2
CO5	3	3	3	2	3	2	3	3	3	3	3	3	3	3	2
CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Avg.	2.83	2.83	2.50	2.33	2.67	2.17	2.83	2.67	2.67	2.67	2.83	2.83	2.83	2.50	2.33

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

UNIT I INTRODUCTION TO PROJECT MANAGEMENT AND PROJECT SELECTION **8Hrs**

Objectives of Project Management- Importance of Project Management- Types of Projects Project Management Life Cycle- Project Selection – Feasibility study: Types of feasibility Steps in the feasibility study.

UNIT II - PROJECT PLANNING AND IMPLEMENTATION **9 Hrs**

Project Scope- Estimation of Project cost – Cost of Capital – Project Representation and Preliminary Manipulations - Basic Scheduling Concepts - Resource Levelling – Resource Allocation.

UNIT III - PROJECT MONITORING AND CONTROL **9 Hrs**

Setting a baseline- Project management Information System – Indices to monitor progress. Importance of Contracts in projects- Teamwork in Project Management - Attributes of a good project team – Formation of effective teams – stages of team formation.

UNIT IV - PROJECT CLOSURE **10 Hrs**

Project evaluation- Project Auditing – Phases of project Audit- Project closure reports Guidelines for closeout reports.

UNIT V - SPECIAL TOPICS IN PROJECT MANAGEMENT **9 Hrs**

Computers, e-markets and their role in Project management- Risk management Environmental Impact Assessment. Case studies in Project management.

Total 45 hours

TEXTBOOKS

1. Project management-for21stcentury-Beenet P Lientz, Kathyn – Pearson Academic Press,1995
2. Project Management-Denislok
3. Project management-DavidI Cleland-McGraw Hill International Ed,1999.

REFERENCES

1. Project management-Gopala krishnan-Mc Millian India Ltd.
2. Project Management-Harry-Maylor- Pearson Publication
3. Project Management-Gray & Larson-Tata McGraw Hill
4. Project Management-Prasanna Chandra- Tata McGraw Hill

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
	INTERPERSONAL COMMUNICATION	**0**	**0**	**2**	**1**

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Year and Semester	**II and IV**		**Contact hours per week** (2 Hrs)	
Prerequisite course				
Course category	**Humanities and Social Sciences Management courses**		**Professional Core**	**Professional Elective**
	✓			
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
Course Objectives	1. To learn various aspects of different cultures and the need for the effective interpersonal communication. 2. To understand the techniques of communication among members in-group. 3. To use language effectively to avoid conflict and tension. 4. To mould the personality` so as to reduce and repair conflicts 5. To learn the need for socialization.			
Course Outcomes	After completion of the course, the students will be able to 1. Recognize aspects of various cultures and the need for interpersonal communication. Give presentation without any inhibition 2. Demonstrate the need for effective communication between two people/groups. 3. Make use of effective and appropriate language at various interpersonal situations to avoid conflict, tension and stress. Participate in debates and discussions to argue effectively and persuasively. 4. Practice the IP principles so as to reduce and repair conflict in interpersonal relationships. 5. Explain family and social relationships and need for socialization. 6. Discuss case studies in relation to IPC			

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

Unit I: PRESENTATION SKILLS **6 Hours**

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Axioms of interpersonal Communication - One minute presentation – Extempore - Formal Presentation on the chosen topics - Greeting and Introducing - Offering Help.

Unit II: APPREHENSION AND ASSERTIVENESS **6 Hours**

Group Discussion - Aggressiveness and assertiveness - perception in interpersonal communication- Making Requests - Telephonic Conversation

Unit III: VERBAL AND NON VERBAL MESSAGES **6 Hours**

Word Stress - Sentence Stress and Intonation-Body language-signs- gestures- postures- kinesics- paralinguistic features (accent, pronunciation, volume, pause, and pitch).

Unit IV: POWER IN INTERPERSONAL RELATIONSHIP **6 Hours**

Conflict in interpersonal relationships - Conflict Resolution - Relationship maintenance and repair- Asking and Giving Permission-Giving Instructions and Directions

Unit V: SOCIALIZATION **6 Hours**

Benefits of socialization- Effect of social media - Case studies (common /domestic /academic /work situations).

Total: 30 Hours

REFERENCES

1. *DeVito, Joseph*, The *Interpersonal Communication* Book, 13th Edition, Published by *Longman* Pub Group, Updated in its *13th edition*, 2000.
2. Kathleen S. Verderber, Inter-Act: Interpersonal Communication Concepts, Skills and Contexts, Rudolph F. Verderber, 2000.
3. Clifford Whitcomb, Effective Interpersonal and Task Communication Skills for Engineers, Atlantic Publishers. 2010.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name** **PROFESSIONAL COMMUNICATION**			L **0**	T **0**	P **2**	C **1**
Year and Semester	**II and IV**		**Contact hours per week** (2 Hrs)			
Prerequisite course	Basic Language Skills					
Course category	**Humanities and Social Sciences Management courses**		**Professional Core**	**Professional Elective**		
	✓					
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**		

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Course Objectives	1. To enhance the Employability and Career Skills of students 2. To enlighten the students towards effective skills for career development 3. To prepare themselves for interviews and develop their confidence 4. To deliver short speeches in front of an audience. 5. To prepare effective and impressive CV and Cover Letters
Course Outcomes	After completion of the course, the students will be able to 1. Face an interview 2. Present effective speeches using verbal and nonverbal techniques 3. Use appropriate vocabulary in formal communication 4. Write CVs effectively and persuasively 5. Comprehend different genres of speech and the implied meanings effectively 6. Participate in Group discussions and debates effectively

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

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

UNIT – I **6 Hrs**

Introduction to Professional communication – importance of Soft Skills – Hard skills – employability and career Skills – Grooming as a professional with values.

UNIT – II **6 Hrs**

Presentation Skills – Self-Introduction – Individual presentation on current affairs - technical presentations – role-play.

UNIT – III **6 Hrs**

Planning a Resume'- writing a resume- writing application letters - understanding the interview process -common types of interview- Preparing for a job interview - mock Interviews.

UNIT – IV **6 Hrs**

Recognizing differences between groups and teams - managing time - managing stress - understanding career management - developing a long-term career plan - making career changes.

UNIT – V **6 Hrs**

Planning for the interview - types of interviews (one to one interview, panel interview telephonic and Skype interview) - interview etiquettes - dress code for interview – frequently asked questions (FAQ).

Total: 30 hrs

TEXTBOOKS

1. **How to Write a CV That Really Works**: A Concise, Clear and Comprehensive Guide to Writing an Effective CV, Paul McGee Hachette UK, 2014
2. **Essentials of Business Communication**, Mary Ellen Guffey, Dana Loewy, Cengage Learning, 2012
3. **Interview Skills that win the job**: Simple techniques for answering all the tough questions, Michael Spiropoulos, Allen & Unwin, 2005
4. **Effective Interviewing and Interrogation Techniques**, William L. Fleisher, Nathan J. Gordon, Academic Press, 2010

REFERENCES

1. http://www.utsa.edu/careercenter/PDFs/Interviewing/Types%20of%20Interviews.pdf
2. http://www.amu.apus.edu/career-services/interviewing/types.htm
3. http://www.careerthinker.com/interviewing/types-of-interview

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code **236EN1A42PA**	**Course Name** **DESIGN THINKING**	L	T	P	C
		3	**0**	**0**	**3**
Year and Semester	**II and IV**	**Contact hours per week** (3Hrs)			
Prerequisite course	NIL				
Course category	**Humanities and Social Sciences Management courses**	**Professional Core**	**Professional Elective**		
	✓				

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	1. To outline the need for Project Management 2. To understand the Project Planning & Management 3. To highlight the need for project control 4. To understand the project evaluation 5. To study the role of project management
Course Outcomes	After completion of the course, the students will be able to 1. Evaluate and select the most desirable projects. 2. Apply appropriate approaches to plan a new project and develop the project schedule. 3. Identify the important ways to monitor a new project. 4. Understand the guidelines to close a project. 5. Evaluate the risk management 6. Students will apply the skills to write a winning project proposal

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO2	3	3	2	2	3	2	3	2	3	3	3	3	3	2	2
CO3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	3	3	2	2	2	2	3	3	2	2	3	3	3	2	2
CO5	3	3	3	2	3	2	3	3	3	3	3	3	3	3	2
CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Avg.	2.83	2.83	2.50	2.33	2.67	2.17	2.83	2.67	2.67	2.67	2.83	2.83	2.83	2.50	2.33

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

Unit 1: **9 Hrs**

An Insight to Learning Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting Remembering Memory Understanding the Memory process, Problems in retention, Memory enhancement techniques

Unit 2 : **9 Hrs**

Emotions: Experience & Expression Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers. Basics of Design Thinking Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts &

Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test

Unit 3 : **9 Hrs**

Being Ingenious & Fixing Problem Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving ,Process of Product Design Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design

Unit 4 : **9 Hrs**

Prototyping & Testing What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing ,Celebrating the Difference Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

Unit 5 : **9 Hrs**

Design Thinking & Customer Centricity Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design. Feedback, Re-Design & Re-Create Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – "Solving Practical Engineering Problem through Innovative Product Design & Creative Solution".

Total 45 hours

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code **234CS1A13TA**	**Course Name**	L	T	P	C
		3	**0**	**0**	**3**

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

<table>
<tr><td></td><td colspan="4">PYTHON PROGRAMMING FOR PROBLEM SOLVING</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Year and Semester</td><td colspan="4">I and I</td><td colspan="4" rowspan="2">Contact hours per week
(3 Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="4"></td></tr>
<tr><td rowspan="4">Course category</td><td colspan="2">Humanities and Social Sciences</td><td colspan="2">Management courses</td><td colspan="2">Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td colspan="4"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Basic Science</td><td colspan="2">Engineering Science</td><td colspan="2">Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td colspan="2"></td><td colspan="2">✓</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Course Objectives</td><td colspan="8">1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops.
4. To define Python functions and call them.
5. To use Python data structures -lists, tuples, dictionaries.
6. To do input/output with files in Python.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">After completion of the course, the students will be able to
1. Develop algorithmic solutions to simple computational problems.
2. Read, write, execute by hand simple Python programs.
3. Structure simple Python programs for solving problems.
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, and dictionaries.
6. Read and write data from/to files in Python Programs.</td></tr>
</table>

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	2	-	1	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
Avg.	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:ALGORITHM FOR PROBLEM SOLVING **9 Hours**

Algorithms - building blocks of algorithms (statements, state, control flow, functions) - notation (pseudo code, flow chart, programming language) - algorithmic problem solving - simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range.

UNIT II:DATA, EXPRESSIONS, STATEMENTS **9 Hours**

Python interpreter and interactive mode - values and types: int, float, Boolean, string, and list – variables – expressions – statements - tuple assignment - precedence of operators – comments - modules and functions - function definition and use - flow of execution - parameters and arguments - Illustrativeprograms: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III:CONTROL FLOW, FUNCTIONS **9 Hours**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else) - Iteration: state, while, for, break, continue, pass - Fruitful functions: return values, parameters, local and global scope, function composition, recursion - Strings: string slices, immutability, string functions and methods, string module, other built-in libraries.

UNIT IV:LISTS, TUPLES, DICTIONARIES **9 Hours**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, advanced list processing, list comprehension - Tuples: tuple assignment, tuple as return value Application: Queue processing using list, vector processing using tuples.

UNIT V:FILES, MODULES, PACKAGES **9 Hours**

Files and exception: text files, reading and writing files, format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - Illustrative programs: word count, copy file.

TOTAL: 45Hours

TEXTBOOKS

2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, O‘Reilly Publishers, 2016.
3. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python –Revised and updated for Python 3.2, Network Theory L., 2011.

REFERENCES

1. John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press, 2013.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code **234CS1A13PA**	**Course Name** **PYTHON PROGRAMMING FOR PROBLEM SOLVING LABORATORY**	L	T	P	C
		0	**0**	**2**	**1**
Year and Semester	I and I	**Contact hours per week** (2 Hrs)			
Prerequisite course					

Document Prepared in “Board of studies” held on Date:19.07.2023	Document Approved in “Academic council” held on Date:22.11.2023

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

Course Objectives

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, and dictionaries.
5. Read and write data from/to files in Python.

Course Outcomes

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

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops.
3. Develop Python programs step-wise by defining functions and calling them.
4. Use Python lists, tuples, dictionaries for representing compound data.
5. Read and write data from/to files in Python.
6. Solve real time problem using python.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3	3	-	-	-	2	3	-	2	-	-	-
CO2	3	3	3	3	3	-	-	-	3	3	-	3	-	-	-
CO3	3	3	3	2	3	-	-	-	3	3	-	3	-	-	-
CO4	2	2	2	3	3	-	-	-	3	3	-	2	-	-	-
CO5	2	2	2	3	3	-	-	-	2	3	-	2	-	-	-
CO6	3	3	3	2	3	-	-	-	3	3	-	2	-	-	-
Avg.	2.50	2.50	2.50	2.67	3.00	-	-	-	2.67	3.00	-	2.33	-	-	-

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

LIST OF EXPERIMENTS:

Lab1: Familiarization with programming environment

Lab 2: Simple computational problems using variables and types conversation

Lab 3: Operators and Expressions

Lab 4: Problems involving if-then-else structures

Lab 5: Iterative problems e.g., sum of series

Lab 6: Functions and Fruitful functions

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Lab 7: Command line arguments

Lab 8: List: Cloning, Comprehension, Processing

Lab 9: Tuples: Vector processing using tuples

Lab 10: Dictionary operations

Lab 11: String functions, slices

Lab 12: File handling operations

Lab 13: Handling Errors and Exception

Lab 14: Raising an Exceptions

Lab 15: Writing modules and packages

Total:30 Hours

<table>
<tr><td>PROGRAM</td><td colspan="5">B.E.-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code
232MC1A13TB</td><td colspan="2" rowspan="2">Course Name
ENGINEERING DRAWING & COMPUTER GRAPHICS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>1</td><td>0</td><td>4</td><td>3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I and I</td><td colspan="3" rowspan="2">Contact hours per week
(5 Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2"></td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td>✓</td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objectives</td><td colspan="6">1. To learn about significance of engineering graphics in orthographic projection.
2. To learn about drawing of plane curves and freehand sketching.
3. To draw projection of points, lines and planes.
4. To learn about projection of solids.</td></tr>
</table>

	5. To learn about isometric projections and CAD tools. 6. To draw clay modelling by simple automobile structure.
Course Outcomes	After completion of the course, the students will be able to 1. Familiarize with the fundamentals and standards of Engineering graphics and perform freehand sketching of basic geometrical constructions and multiple views of objects 2. Project orthographic projections of lines and plane surfaces. 3. Draw projections, solids, and development of surfaces. 4. Visualize and to project isometric and perspective sections of simple solids. 5. Apply the Engineering graphics concept for clay modeling of Automobile parts 6. Apply the Engineering graphics concept for design the various components of industrial products.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2							3		3		2	
CO2	3	2	2							3		3		2	
CO3	2	2	2							3		3		2	
CO4	3	2	2							3		3		2	
CO5	3	3	3							3		3		2	
CO6	3	2	2							3		3		2	
Avg.	2.8	2.2	2.2							3		3		2	

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

UNIT-I CURVES AND FREEHAND SKETCHING **15Hours**

Geometrical 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.

Freehand sketching of orthographic projections (front view, side view and top view) of three dimensional object.

Freehand sketching of three dimensional object from the orthographic views.

UNIT- II PROJECTION OF POINTS, LINES AND PLANE SURFACE (Use First angle projections only) **15Hours**

Orthographic projection of points.

Projection of straight lines - inclined to both the planes – Determination of true lengths and true inclinations by rotating line method and traces.

Projection of planes (Square, Rectangular, Triangular, Pentagonal, Hexagonal and Circular planes only)plane inclined to both reference planes by change of position method

UNIT-III PROJECTION OF SOLIDS **15 Hours**

Projection of simple solids like prisms, pyramids, cylinder and cone - when the solid resting on HP and its axis inclined to HP .

Section of solids (Square, pentagonal, Hexagonal Pyramids & cone only) - solids in simple vertical position and its axis perpendicular to HP - cutting plane is inclined to HP and perpendicular to VP – Front view, sectional top view and True shape of the section.

UNIT-IV COMPUTER AIDED DRAFTING USING AUTO CAD SOFTWARE **15 Hours**

Basic commands for all geometric shapes – 2 D drafting practice (2D drafting – Three exercise / Isometric drawing – Three Exercise)

UNIT V COMPUTER AIDED DRAFTING USING SOLIDWORKS SOFTWARE **15Hours**

Basic commands for all geometric shapes – 3D drafting practice – 2 exercise.

Project work - Clay modeling of simple automobile structure – Car, truck, earth movers with wheels.

TOTAL :75 HOURS

TEXTBOOKS

1. Natrajan K.V., ―A text book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., ―Engineering Graphics‖, New Age International (P) Limited, 2008.

REFERENCES

1. Bhatt N.D. and Panchal V.M., ―Engineering Drawing‖, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., ―Engineering Drawing‖, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., ―Engineering Drawing‖ (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. andDuff,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.
5. N S Parthasarathy And Vela Murali, ―Engineering Graphics‖, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., ―Engineering Drawing‖, Pearson, 2nd Edition, 2009.
7. Autodesk AutoCAD Certified User Study Guide-William G. Wyatt Ed.D., CET, 2021
8. Computer Aided Engineering Design with Solidworks Hardcover – Onwubolu ,2011

PROGRAM	B.E.-Naval Architecture & Offshore Engineering

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Course Code	Course Name	L	T	P	C
232MC1A33TC	ENGINEERING MECHANICS	3	0	0	3

Year and Semester	I and II	**Contact hours per week** (3 Hrs)
Prerequisite course		

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

Course Objectives

1. To understand about forces and its effects
2. To analyze the forces under equilibrium
3. To learn about laws of friction on various applications
4. To calculate centroid and moment of inertia of various sections
5. To evaluate the displacement, velocity and acceleration of particles and rigid bodies.

Course Outcomes

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

1. Analyze the resultant force and moment for a given force system using laws of mechanics.
2. Analyze the statics of rigid bodies in two dimensions
3. Determine the centroid, moment of inertia of various sections.
4. Apply the laws of motion to solve the real life dynamic problems
5. Solve real time application of rigid bodies under equilibrium conditions
6. Resolve various forces and determine the impact of the forces on the bodies

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2									1	1	1	
CO2	3	3	2	1								1	1	1	
CO3	3	3	2									1	1	1	
CO4	3	3	2	1								1	1	1	
CO5	3	3	2	1								1	1	1	
CO6	3	3	2									1	1	1	
Avg.	3	3	2	1								1	1	1	

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

UNIT I BASICS AND STATICS OF PARTICLES **9Hours**

Principles of statics: Introduction to vector approach – free body diagrams- forces in a plane – forces in space – concurrent forces – resolution of forces – equilibrium of particles

UNIT II STATICS OF RIGID BODIES IN TWO DIMENSIONS **9Hours**

Moment of force about a point – moment of force about an axis – moment of a couple – equivalent force couple system – rigid body equilibrium – support reactions.

Unit III PROPERTIES OF SURFACES **9 Hours**

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula

UNIT IV DYNAMICS OF PARTICLES **9 Hours**

Dynamics of particles: kinematics of particles – rectilinear motion – relative motion – relative motion – position, velocity and acceleration calculation in cylindrical coordinates. Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V APPLICATION OF STATICS **9 Hours**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – ladder friction – wedge friction – analysis of trusses – method of joints and method of sections. Tyre–pavement friction: A factor that can affect the rate of vehicle crashes- A Case Study

TOTAL : 45 HOURS

TEXTBOOKS

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

REFERENCES

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

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
232NA1A33PA	**ENGINEERING FLUID MECHANICS**	**3**	**0**	**0**	**3**
Year and Semester	I and III	**Contact hours per week** (3 Hrs)			

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Prerequisite course				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
		✓		
Course Objectives	1. To provide fundamental knowledge of fluids, its properties and behaviour under various conditions of internal and external flows. 2. To Solve the fluid flow governing equations by taking suitable constraints and assumptions and evulate the major and minor losses in pipes 3. To Interpret the boundary layer aspects of laminar and turbulent flows and perform dimensional analysis on any real-life problems 4. To understand the importance, function and performance of hydro machinery. 5. To to evaluate the performance characteristics of hydraulic turbines.			
Course Outcomes	After completion of the course, the students will be able to 1. Apply the concept of fluid and its properties, manometry, hydrostatic forces acting on different surfaces 2. Solve problem using basic laws of fluids, flow patterns, viscous flow through ducts and their corresponding problems. 3. Apply concepts related to boundary layer theory, flow separation, basic concepts of velocity profiles, dimensionless numbers and dimensional analysis 4. Explain the function and performance of hydraulicpump. 5. Explain the functions and the performance characteristics of hydraulic turbines 6. Analyse the fluid flow in real life situtations			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3										1		2	
CO2	3	3										1		2	
CO3	3	3		3								1		2	
CO4	3	3		2								1		2	
CO5	3	3		2								1		2	
CO6	3	3		2								1		2	
Avg.	3	3		2.25								1		2	

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

UNIT 1 Introduction to Fluid Staticsand Hydrostatic Forces **9 hrs**

Definition of fluid, Concept of continuum, Fluid properties, Classification of fluids, Pascal's Law and Hydrostatic Law, Pressure and its variation in a static Fluid, Measurement of static fluid pressure: Manometers.Buoyancy and floatation: Meta center, stability of floating body.

Submerged bodies. Calculation of metacenter height. Stability analysis and applications

UNIT 2 Fluid Kinematics and Dynamics **9 hrs**

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow. Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.Closed conduit flow: Reynold's experiment-Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line

UNIT 3 Boundary layer flow and Dimensional Analysis **9 hrs**

Boundary layers, Laminar flow and turbulent flow, Boundary layer thickness, Momentum integral equation, Drag and lift, Separation of boundary layer, Methods of preventing the boundary layer separation.Dimensional homogeneity, Buckingham π theorem

UNIT 4 Hydraulic Pumps **9 hrs**

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.Reciprocating pumps: Working, Discharge, slip, indicator diagrams

UNIT 5Hydraulic Turbines **9 hrs**

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies–draft tube-theory-functions and efficiency.Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer

TOTAL : 45 HOURS

TEXTBOOKS:

1. R.K. Bansal, Strength of Materials, 4th edition , Laxmi Publications Pvt. Ltd, New Delhi, 2010.
2. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

REFERENCES:

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

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

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

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code **232NA1A43TA**	**Course Name** **ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS***	L	T	P	C
		3	**0**	**0**	**3**
Year and Semester	II and IV	**Contact hours per week** (3 Hrs)			
Prerequisite course	• Python Programming • Probability				

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

Course Objectives	1. Gain a historical perspective of AI and its foundation. 2. To learn the different search strategies in AI. 3. To enable problem solving through probability reasoning 4. To learn various decision process 5. Become familiar with basic principles of AI towards knowledge representation.
Course Outcomes	After completion of the course, the students will be able to 1. Study of the design of intelligent computational techniques 2. Build intelligent agents for search and games 3. Solve AI problems through programming with Python 4. Learning optimization and inference algorithms for model learning 5. Design and develop programs for an agent to learn and act in a structured environment. Improve problem solving skills using the acquired knowledge in the areas of, reasoning and automatic programming.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	3	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	3	-	-	-	-	-	-	-	-	-	-
CO6	2	1	3	3	2	-	-	-	-	-	-	-	-	-	-
Avg.	2.33	1.83	2.17	2.33	2.33	-	-	-	-	-	-	-	-	-	-
CORRELATION LEVELS		1. SLIGHT (LOW)			2. MODERATE (MEDIUM)					3. SUBSTANTIAL (HIGH)					

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9 Hours

Concept of AI, history - current status – scope - agents – environments - Problem Formulations - Review of tree and graph structures - State space representation - Search graph and Search tree.

UNIT II PROBLEM SOLVING METHODS 9 Hours

Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems -Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games.

UNIT III KNOWLEDGE REPRESENTATION 9 Hours

Introduction to knowledge representation - Proportion logic - First order logic I and II - Inference in first order logic I and II -Answer extraction.

UNIT IV MACHINE LEARNING TECHNIQUES 9 Hours

Supervised learning - Unsupervised learning - Fuzzy logic, ANN - KNN - Support vector machine - Reinforcement learning - Deep learning.

UNIT V APPLICATIONS 9 Hours

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware –Perception – Planning – Moving.

TOTAL: 45 HOURS

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

TEXTBOOKS

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

REFERENCES

1. Elaine Richand Kevin Knight, "Artificial Intelligence", Tata McGraw Hill, 2003.
2. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
3. Dan W.Patterson, ―Introduction to Artificial Intelligence and Expert Systems, PHI, 2006.
4. Nils J. Nilsson, ―Artificial Intelligence: A new Synthesis‖, Harcourt Asia Pvt. Ltd., 2000.
5. Saroj Kaushik, "Artificial Intelligence", 1st Edition, Cengage learning India publisher, 2011.

<table>
<tr><td>PROGRAM</td><td colspan="5">B.E.-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
232EE1A23TA</td><td colspan="2">Course Name
BASIC ELECTRICAL AND ELECTRONICS ENGINEERING</td><td>L
3</td><td>T
1</td><td>P
0</td><td>C
4</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I and II</td><td colspan="3" rowspan="2">Contact hours per week
(4 Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2"></td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td>✓</td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objectives</td><td colspan="6">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</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">After 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.</td></tr>
</table>

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	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

POS/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
Avg.	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 **12 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 **12 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 **12 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 **12 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 **12 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.

Total:60 Hours

TEXTBOOKS

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.-Naval Architecture & Offshore Engineering**				
Course Code **232EE1A23PA**	**Course Name** **BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY**	L	T	P	C
		0	**0**	**2**	**1**
Year and Semester	I and II	**Contact hours per week** (2 Hrs)			
Prerequisite course					

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

Course Objectives	1. To acquire knowledge with an adequate work experience in the measurement of different quantities 2. Expertise in handling the instruments involved.

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Course Outcomes	After completion of the course, the students will be able to 1. Demonstrate instruments such as ammeter and voltmeter for measuring resistance, power and power factor. 2. Compare the vector diagrams of series and parallel R,L and C circuits 3. Explain how to measure power input to three phase induction motor using watt meters 4. Illustrate the characteristics of PN diode, Zener diode and JFET. 5. Contrast the working principle of half wave and full wave rectifier 6. Combine measuring instruments for different parameters in engineering applications. .

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	-	-	-	2	-	-	-	2	2	-
CO2	2	2	3	2	-	-	-	-	1	2	-	2	3	1	2
CO3	2	2	2	2	1	-	-	-	2	2	2	2	2	2	2
CO4	2	2	2	2	1	-	-	-	1	2	-	1	3	1	2
CO5	2	2	2	2	2	-	-	-	3	1	3	3	3	2	2
CO6	2	2	3	2	3	-	-	-	2	3	3	3	3	1	2
Avg.	2	2	2.3	1.8	1.8	-	-	-	1.8	2	2.7	2.2	2.7	1.5	1.7

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

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 3 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 : 30hrs

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
232NA1A33TB	**MECHANICS OF MATERIALS**	**3**	**1**	**0**	**4**

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Year and Semester	IIand III		**Contact hours per week** (4 Hrs)	
Prerequisite course	Engineering Mechanics			
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 terms of strength of materials: stress, strain and stress-strain diagram
2. To determine displacements and stresses for axial loads and calculate shear stresses due to torsion and design of circular bars
3. To determine normal and shear stresses in beams and design of beams using Shear force diagram and bending moment diagram
4. To determine the combine loading and learn the theory of failure.
5. To calculate the load on columns and strain energy in beams.

Course Outcomes

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

1. Solve problems in stresses and design for different cases of loads
2. Analyse structural members for stresses, strains and deformations.
3. Analyse the structural members subjected to bending and shear loads.
4. Calculate stresses due to combined loads shafts subjected to twisting loads and identify the failure using failure theories
5. Analyse the short columns for stability
6. Solve basic engineering problems using the principles of mechanics applied to different materials

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		-										
CO2	3	3	2												
CO3	3	3	2	2											
CO4	3	3	2	2											
CO5	3	3	2	2											
CO6	3	3	2	2											
Avg.	3	3	2	2											

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

UNIT 1 Stresses and Strains **9 hrs**

Introduction, Properties of materials, Stress, Strain and Hooke's law, Stress strain diagram for brittle and ductile materials, True stress and strain, Calculation of stresses in straight, Stepped and tapered sections, Composite sections, Stresses due to temperature change, Shear

stress and strain, Lateral strain and Poisson's ratio, Elastic constants and relations between them.

UNIT 2 Analysis of Stress and Strain **9 hrs**

Introduction to three-dimensional state of stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear tress, Mohr circle for plane stress conditions.Cylinders - Thin cylinder: Hoop's stress, maximum shear stress, circumferential and longitudinal strains, Thick cylinders: Lames equations.

UNIT 3 Shear Force and Bending Moment **9 hrs**

Shear Force and Bending Moment - Type of beams, Loads and reactions, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads, uniformly distributed constant / varying loads.Stress in Beams - Bending and shear stress distribution in rectangular, I and T section beams.

UNIT 4 Theories of Failure **9 hrs**

Theories of Failure - Maximum Principal stress theory, Maximum shear stress theory.Torsion - Circular solid and hallow shafts, Torsional moment of resistance, Power transmission of straight and stepped shafts, Twist in shaft sections, Thin tubular sections, Thin-walled sections.

UNIT 5 Columns **9 hrs**

Columns - Buckling and stability, Critical load, Columns with pinned ends, Columns with other support conditions, Effective length of columns, Secant formula for columns.Strain Energy - Strain energy due to axial, shear, bending, torsion and impact load.

TEXTBOOKS

1 J M Gere, B J Goodno, Mechanics of Materials, Cengage Eighth edition 2013.
2 P N Chandramouli, Fundamentals of Strength of Materials ,PHI Learning Pvt. Ltd 2013.
3 R K Rajput , Strength of Materials S. Chand and Company Pvt. Ltd 2014.

REFERENCES

1. R. Subramanian ,Strength of Materials Oxford 2005
2. S. S. Ratan ,Strength of Materials Tata McGraw Hill 2nd Edition, 2008
3. S C Pilli and N Balasubramanya ,Mechanics of materials, Cengage 2019
4. Ferdinand Beer, Russell Johston, John Dewolf, David Mazurek ,Mechanics of Materials McGraw Hill Education (India) Pvt. Ltd Latest edition.
5. R C Hibbeler ,Mechanics of Materials, Pearson Latest edition

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6. A. P. Boresi and O. M. Sidebottom ,Advanced Mechanics of Materials—John Wiley & Sons
7. Dr. Sadhu Singh ,Strength of Material,Khanna Publishers.
8. S. P. Timoshenko ,Strength of Material, Vol. I and II ,EWP Press.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C
232MC1A23PB	**WORK SHOP PRACTICES**	**0**	**0**	**4**	**2**
Year and Semester	I and II	**Contact hours per week** (4Hrs)			
Prerequisite course					

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

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

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

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

MACHINING

Introduction and familiarization of operation of laths, drilling machines, shaping, milling and grinding machines - Safety- personal, tools, machines and environmental - Measuring tools and methods of measurement, reading of sketches and drawing, cutting tools, tool geometry

- setting of tools methods of fixing of jobs on chucks, vices, jigs and fixtures - Speeds and feeds of machines - Operations of machines - Practical exercises on machines to develop and improve hands on skills.

FITTING

Introduction and familiarization of various hand tools- Measuring, marking, cutting, holding and assembly tools, materials, parts, uses and safety of tools and personal safety - Process and procedures for measuring, understanding of sketches and drawing - Marking and job holding methods - Process of chipping, filling, hack sawing, drilling, tapping, dyeing, assembling and dismantling of components - Practical exercises to develop and improve hands on skills.

ELECTRIC ARC WELDING

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

OXY – ACETYLENE WELDING

Introduction – familiarization of tools and equipment - Gas cylinders, regulators, hoses and gas welding and gas cutting blow pipes -DS Processors - Procedures for setting up the equipment - 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 equipment and environmental safety-Procedures for gas welding, brazing and gas cutting - Different methods of joints in different positions and defects of joints, testing of joints - Practical exercises to develop and improve hands on skill of gas welding, brazing and gas cutting.

TOTAL: 30 Hours

PROGRAM	**B.E-Naval Architecture & Offshore Engineering**				
Course Code: 232NA1A14TA	**Course Name :** **INTRODUCTION TO NAVAL ARCHITECTURE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Year and Semester	I and I	**Contact hours per week** (3Hrs)			
Prerequisite course	NIL				

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

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

Course Objective	1. To understand various types of ships and shipyard processes. 2. To obtain knowledge on ship's offset table and generation of lines plan. 3. To understand the concepts of ship stability.
Course Outcome	After completion of the course, the students will be able to 1. Classify different types of ships and their functions. 2. Compare general arrangement plans of various ships. 3. Illustrate ships' lines plan, stem, and stern profiles. 4. Apply integration rules and calculate hydrostatic properties of ships. 5. Explain the hydrostatic curves of ships. 6. Develop the sectional area curves and Bonjean curves.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	-	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO6	3	2	2	2	2	-	-	-	-	-	-	-	2	2	2
Avg.	3.00	2.83	2.67	2.67	2.80	-	-	-	-	-	-	-	2.00	2.83	2.00
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

UNIT I – SHIP TYPES AND THEIR TERMINOLOGY **9 Hrs**

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

UNIT II - GENERAL ARRANGEMENT FOR DIFFERENT VESSELS **9 Hrs**

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

UNIT III - LINES PLAN AND INTEGRATION RULES **9 Hrs**

Lines plan – fairing process- table of offsets, Views of lines plan, stem and stern profiles, Forms coefficients, Integration rules – Trapezoidal rule, Simpson's rule (1-4-1, 1-3-3-1 and 5, 8,-1 rule), half ordinate rule, Tchebycheff's rule.

UNIT IV - HYDROSTATIC CALCULATIONS **9 Hrs**

Calculations of area, volume, centroid, moments of area and other hydrostatic parameters.

UNIT V - SECTIONAL AREA AND BONJEAN CURVES
9 Hrs

Freeboard and load line regulation, Bonjean curves, Sectional area curves.

Total: 45 Hours

TEXT BOOKS

1. Edward V. Lewis, Principles of Naval Architecture (Volume 1 - Stability and Strength), 3rd edition, SNAME, U.S.A, 1988.
2. E. C. Tupper, Introduction to Naval Architecture, 5th edition, Butterworth-Heinemann (Elsevier), 2013.

REFERENCES

1. E. C. Tupper, K. J. Rawson, Basic Ship Theory (Volume 1- Hydrostatics and Strength), 5th edition, Butterworth-Heinemann (Elsevier), 2001.
2. George J. Bruce, David J. Eyres , Ship Construction, 7th edition, Butterworth-Heinemann (Elsevier), 2012.

<table>
<tr><td>PROGRAM</td><td colspan="5">B.E-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code
232NA1A24TB</td><td colspan="2" rowspan="2">Course Name:
ELEMENTS OF OFFSHORE ENGINEERING</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I and II</td><td colspan="4" rowspan="2">Contact hours per week
(3Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td>Course Objectives</td><td colspan="6">1. To understand the classification and functions of various offshore structures.
2. To understand the installation methods of offshore structures.
3. To understand the materials used in offshore structures.
4. To explain the maintenance and inspection strategies of offshore structures.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">After completion of the course, the students will be able to
1. Explain water wave mechanics and forces on offshore structures by water waves.</td></tr>
</table>

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	2. Distinguish between types of offshore structures based on their functions. 3. Identify installation methods of offshore structures 4. Choose material for offshore structures construction. 5. Develop inspection and maintenance schedules for offshore structures. 6. Explain functions of mooring and riser systems.

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

UNIT I – INTRODUCTION TO OFFSHORE STRUCTURES **9 hrs**

Offshore Structures for oil and gas: Fixed offshore platforms (jackets, gravity platforms, articulated towers); superstructure & foundation, floating platforms (semi-submersibles, jack-ups, TLPS, FPSOs, pipe laying barges) – functional and structural requirements.

UNIT II – OFFSHORE PIPELINE& RISERS **9 hrs**

Introduction offshore pipe line- - Pipeline Elements (Fittings, valves and instruments), Piping material selection (PMS), Pipeline Drawings (P&ID), Field layouts, Alignment sheet, Crossing details and Trench details), Codes and Standards for offshore pipeline; Riser – different types of risers, riser components.

UNIT III – OFFSHORE STRUCTURE ELEMENTS AND INSTALLATION **9 hrs**

Various components in offshore platforms, Topsides and General layout considerations of offshore platforms. Offshore structure transportation, launching and upending, Foundation systems for offshore structures, Mooring, station keeping, berthing systems, launching and installation of offshore structures and pipe lines, Regulations and codes of practice, Dredging methods and equipment.

UNIT IV– INSPECTION AND MAINTENANCE OF OFFSHORE STRUCTURES
9 hrs

Corrosion and corrosion protection methods, Marine growth, Inspection and testing of offshore structures- methods and equipment, Structural health monitoring and Repair of offshore structures, Life extension studies.

UNIT V – OFFSHORE RENEWABLE ENERGY **9 hrs**

Principles of energy conversion from the sea, Wave Energy-conversion techniques-prototypes-Tidal Power plants-principle and construction- offshore wind energy conversion – principles

and prototype construction- Offshore Thermal Energy Conversion (OTEC)-principles and design concepts- **Total:45 Hrs**
TEXTBOOKS 7. Subrata K.Chakarabarti, Handbook of Offshore Engineering, Vol. 1 and 2, 1st edition, Elsevier Science, Netherlands, 2005. 8. Thomas H.Dawson, Offshore Structural Engineering, 1st edition, Prentice Hall, 1983. 9. J.S Mani, Coastal Hydrodynamics, , PHI Publishing, 2012. 10. A.J.Hermans., Water waves and ship hydrodynamics, 2nd edition, Springer, 2011. 11. Subrata K.Chakarabarti, Hydrodynamics of offshore structures, 1st edition, WIT Press, Southampton, UK, 1987. **REFERENCES** 12. Bernard Le Mehaute, An Introduction to Hydrodynamics and water waves, Springer, 1976. 13. Graff, W.J, Introduction to Offshore Structures, (Design, Fabrication, Installation), 1st edition, Gulf professional publishing (Elsevier), 1981.

<table>
<tr><td>PROGRAM</td><td colspan="6">B.E-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code
232NA1A34TD</td><td colspan="2" rowspan="2">Course Name:
INTRODUCTION TO MARINE ENGINEERING</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I and I</td><td colspan="3" rowspan="2">Contact hours per week
(3 Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="5">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1. To understand the types of machinery in Engine room.
2. To understand oil Purifiers and Evaporators.
3. To understand the working of Steering Gear mechanism.</td></tr>
</table>

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Course Outcome	After the completion of the course students will be able to: 1. Demonstrate the Various machineries available in the engine room. 2. Explain the purpose and working of Evaporators. 3. Demonstrate about the usage of filters and heat Exchangers. 4. Explain the principles of Oil purification for Engines. 5. Demonstrate the working of a Steering Gear. 6. Identify the Marine and Auxiliary machinery used in ships.

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

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

UNIT– I ENGINE ROOM LAYOUT **9hrs**

Lay out of main and auxiliary machinery in engine rooms in different ships. Piping arrangement for steam, Lube oil and Cooling system with various fittings. Domestic fresh water and sea water hydrophore system

UNIT – II EVAPORATORS **9hrs**

Construction and Operation of different types of evaporators. Fresh Water generators and distillers. Conditioning arrangements of distilled water for drinking purpose. Care Maintenance of pumps of various types

UNIT –III FILTERS AND HEAT EXCHANGERS **9hrs**

Strainers and filters, types of marine filters, auto cleaner and Duplex filters, Static filters. tubular and plate type, reasons of corrosion, tube removal, plugging, and materials used

UNIT – IV OILPURIFICATION, BLOWERS AND COMPRESSORS **9hrs**

Theory of oil Purification, Principles of operation and construction of different Centrifuges for heavy fuel and lubricating oil, Uses of compressed air

UNIT – V STEERING GEARS **9hrs**

Operation and Constructional details of various types of steering machinery. Telemotor systems, transmitters and receivers Variable Delivery Pumps used in steering gears.

Hunting action of Steering gear. Emergency Steering arrangement. Care and Maintenance of Steering Gear Plants. Shafting : Methods of shaft alignment, constructional details and working of Thrust blocks. Sealing Glands. Stresses in Tail End, Intermediate and Thrust Shafts

Total:45 Hrs

TEXT BOOKS

1. H D McGeorge, Marine Auxiliary Machinery,7th Edition, Butterworth Heinemann,1995.
2. D A Taylor, Introduction to Marine Engineering,2nd Edition, Elsevier Butterworth-Heinemann1996.
3. M Khetagurov, Marine Auxiliary Machines and systems, Soviet Union,2004.

REFERENCES

1. Leslie Jackson, Thomas D Morton, Reeds Marine engineering series volume 8: General engineering knowledge for marine engineers,2003.
2. Everett C Hunt, Modern Marine Engineers Vol.1,Cornell Maritime press,1999.

<table>
<tr><td>PROGRAM</td><td colspan="5">B.E-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code:
232NA1A34TE</td><td rowspan="2">Course Name :

THEORY OF SHIPS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Year and Semester</td><td>II and III</td><td colspan="4" rowspan="2">Contact hours per week

(3Hrs)</td></tr>
<tr><td>Prerequisite course</td><td>Introduction to Naval Architecture</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="5">To evaluate the ship stability parameters in static, dynamic and damage conditions.</td></tr>
<tr><td>Course Outcome</td><td colspan="5">After completion of the course, the students will be able to
1. Explain the mechanism involved in stability of ships.</td></tr>
</table>

	2. Identify the effect of cargo on ship stability. 3. Explain the small angle and large angles stability of ship. 4. Estimate the dynamical stability of ship. 5. Examine the longitudinal stability of ship. 6. Examine the damage stability of ship for various conditions.

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

UNIT I – INTRODUCTION TO STABILITY

9 hrs

Introduction to state of equilibrium (Stable, Unstable and Neutral equilibrium for floating and submerged body); Correcting stable and neutral equilibrium Stability terms - Metacentre, Metacentric radius, Metacentric height, Righting lever, Righting moment, and Heeling moment; Effect of beam and freeboard on stability; Effect of density on stability.

UNIT II – CARGO EFFECT ON STABILITY **9 hrs**

Effect of weights on C.O.G- Shifting, lifting, loading & unloading condition; Effect of superstructure on stability; Free surface effect; Tender and Stiff ship; List.

UNIT III – TRANSVERSE STABILITY **9 hrs**

Intact stability- GM, GZ at small angles of inclinations,angle of loll, wall sided ships; Diagram of statically stability (GZ - curve), Characteristics of GZ – curve, IMO criteria; Methods for calculating the GZ – curve, Cross curves of stability; DyFnamical stability - Diagram of Dynamical stability, Dynamical stability criteria, Wind and heeling effect.

UNIT IV – LONGITUDINAL STABILITY **9 hrs**

Trim, Longitudinal metacentre, Longitudinal metacenter, longitudinal centre of flotation; Moment to change trim, Trimming moment; Trim calculations - addition, removal and transference of weight, change of density of water, ballasting.

UNIT V – DAMAGE STABILITY **9 hrs**

Damage stability, Flooding Damage condition, Permeabilities, Bulkhead deck,Margin line,Bilging of compartment, Added mass method and Lost buoyancy method,

Permeability; Deterministic and Probabilistic approach; Damage stability rules; Floodable length, Statutory regulation for damage stability **Total:45 Hrs**
TEXT BOOKS 1. Edward V. Lewis, Principles of Naval Architecture (Volume 1 - Stability and Strength), 3rd edition , SNAME, 1988. 2. David J. Eyres, Ship Construction Sketches and notes, 2nd edition, Butterworth-Heinemann, 2000. 3. E. C. Tupper and K. J. Rawson, Basic Ship Theory (Volume2- Ship Dynamics and Design), 5th edition, Butterworth Heinemann (Elsevier), 2001. **REFERENCES** 1. 1. John S.Letcher Jr, J.Randolph Pauling, The Principles of Naval Architecture Series (The Geometry of Ships), , SNAME, 2009.

<table>
<tr><td>PROGRAM</td><td colspan="5">B.E-Naval Architecture & Offshore Engineering</td></tr>
<tr><td rowspan="2">Course Code
232NA1A44TH</td><td colspan="2">Course Name
MARINE HYDRODYNAMICS</td><td>L
3</td><td>T
0</td><td>P
0</td><td>C
3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">II and IV</td><td colspan="3" rowspan="2">Contact hours per week

(3 Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Engineering fluid mechanics</td></tr>
<tr><td rowspan="5">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1. To understand fluid mechanics in hydrodynamics.
2. To understand water wave mechanics and wave load estimation.</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After completion of the course, the students will be able to:
1. Apply fluid mechanic principles in ship and wave hydrodynamics.
2. Estimate different forces on the submerged bodies.</td></tr>
</table>

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	3. Classify different types of waves and their characteristics. 4. Explain the concepts of water wave mechanics. 5. Illustrate the wave process and wave data analysis. 6. Discuss the wave impacts on coastal structures

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

UNIT I - FLUID STATICS AND KINEMATICS **9 hrs**

Fluid and their properties, pressure measurement and manometers, basic principles of hydrostatic forces on surfaces, buoyancy and floatation– Problems

Types of fluid flow; Lagrangian and Eulerian methods of flow description, substantial derivative, flow visualization, continuity equation, circulation and vorticity, velocity potential and stream function– Problems - Cauchy-Riemann Equations and problems

UNIT II - IDEAL FLOW **9 hrs**

Equation of motion – Euler's equation of motion – Bernoulli's equation – Assumptions, problems, practical application – Venturimeter and pitot tube-Venturiflume

Uniform flow, Source, Sink, Doublet, vortex flow –combination of flows - Magnus effect – Problems. Introduction to linear wave theory

UNIT III – VISCOUS FLOW **9hrs**

Viscosity, Bernoulli's equation for real fluids, Flow through a pipe of circular section, Poiseuille law, flow of fluid between parallel plates– Coutte's law, Navier-Stokes equation, Dimensional analysis, Reynolds number and Froude number, Concepts of Boundary layer, Separation of Boundary Layer – Problems

UNIT IV– FLOW THROUGH PIPES **9hrs**

Loss of energy in pipes – major and minor, Darcy-Weisbach equation, Chezy's formula, pipes in series and parallel, equivalent pipe, concept of siphon, Flow through nozzles, concept of water hammer in pipes – Problems

UNIT V – FLOW PAST SUBMERGED BODIES **9hrs**

Introduction, Force Exerted by a flowing fluid on a stationary body, drag, lift forces – expression, Bluff body, streamlined body, terminal velocity, Karman Vortex trail,

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Concept of added mass, Added mass of cylinders; Flow around aerofoil, stall point, Application of marine hydrodynamics in floating structure design – Problems **Total:45 Hrs**
TEXT BOOKS 1. Newman J. N, Marine Hydrodynamics, 9th Edition, MIT Press, Cambridge, MA, 1999. 2. R.K.Rajput, A text book of Fluid Mechanics, 7th edition, S.Chand and Company Limited, New Delhi , 2007. 3. K.L.Kumar, Engineering Fluid Mechanics, 1st edition Reprint, Eurasia Publishing House (P) Ltd, New Delhi, 2006. **REFERENCES** 1. H.R.Vallentine, Applied Hydrodynamics, 2nd edition, Butterworth and Co. Publishers Ltd., 1967. 2. Hermann Schlichting and Klaus Gersten, Boundary Layer Theory, Springer, 9th edition, 2001.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**			
Course Code: 232NA1A44TI	**Course Name :** MARINE MATERIALS AND WELDING TECHNOLOGY	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Year and Semester	II Year and IV Semester	**Contact hours per week** (3Hrs)			
Prerequisite course	NIL				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
			✓	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
Course Objectives	1. To introduce various types of materials used in shipbuilding industry. 2. To understand the general aspects of welding processes and parameters. 3. To understand weld defects and NDT methods.			
Course Outcomes	After completion of the course, the students will be able to 1. Compare various types of materials used in shipbuilding industry. 2. Explain the welding parameters. 3. Experiment with the different metal joining techniques used in shipbuilding. 4. Illustrate the welding generated stresses, their causes and remedial measures. 5. Assess the quality of welding using destructive and non-destructive testing. 6. Apply industrial practices followed in welding in shipbuilding industry.			

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POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	3	-	-	-	-	3	3	3	3
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	2	2	2	2	-	-	-	-	-	-	3	3	3	3
CO4	3	2	2	2	2	-	-	-	-	-	-	3	3	3	3
CO5	3	2	2	2	3	-	-	-	-	-	-	3	3	3	3
CO6	3	2	2	2	3	-	-	-	-	-	-	3	3	3	3
Avg.	3.0	2.2	2.0	2.0	2.5		3.0					3.0	3.0	3.0	3.0

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

UNIT I – INTRODUCTION TO MARINE MATERIALS **9 hrs**

Introduction to Materials of construction and marine environment (Steel, Aluminum and Composites), fiber reinforced composites, Steel and Aluminum alloys in shipbuilding applications.

UNIT II – INTRODUCTION TO WELDING VARIABLES **9 hrs**

Welding Parameters (Current, Arc, Voltage, Speed, Feed, etc.), fusion welding power source, types and characteristics, metal transfer mechanism.

UNIT III – WELDING METHODS IN SHIPBUILDING **9 hrs**

Fusion methods MMAW, GMAW, SAW, Electro gas welding, Electro slag welding, single side welding, multi electrode welding, FSW, Heat generation, Introduction to joining techniques used in composites in shipbuilding.

UNIT IV – DEFECTS & DISTORTION IN WELDING **9 hrs**

Types of welding defects, Residual Stress, Distortion mechanism, distortion control through design, fabrication technique - Case study and remedial measures - Corrosion and corrosion protection methods.

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 Hrs

TEXT BOOKS

1. Nisith R. Mandal , Ship Construction and Welding, 1st edition, Springer Nature Singapore Pte Ltd. , 2016.
2. Thomas Lamb, Ship Design and Construction (Volumes 1 and 2), 1st edition , SNAME, 2004.
3. Robert Taggart, Ship Design and Construction, SNAME, 1980.
4. George J. Bruce, David J. Eyres , Ship Construction, 7th edition, Butterworth-Heinemann (Elsevier), 2012.

REFERENCES

1. Richard Little, Welding and Welding Technology, McGraw Hill, 1st edition, 2001.
2. Richard Lee Storch, Colin P. Hammon, Howard McRaven Bunch and Richard C. Moore, Ship Production, 2nd edition, SNAME, 1995.

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

3. Welding handbook, American Welding Society, volume 1 & 2, 7th edition, USA,1983.

PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code	Course Name	L	T	P	C
232NA1A44TJ	THERMODYNAMICS AND MARINE MACHINERY	3	0	0	3
Year and Semester	II Year and IV Semester	Contact hours per week (3Hrs)			
Prerequisite course	NIL				

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

Course Objectives	1. To understand the concepts of heat transfer. 2. To understand the heat flow direction. 3. To understand the working principles of marine machinery.
Course Outcomes	After completion of the course, the students will be able to 1. Explain thermodynamics laws and their applications 2. Explain the concept of entropy and availability 3. Illustrate the thermodynamics cycles and their applications 4. Explain enthalpy, reversible and irreversibility 5. Explain the working principles of various machines used in marine vehicles 6. Summarize the concepts of heat flow

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	2	-	-	-	-	-	-	-	3	2	3	2
CO6	3	3	2	2	-	-	-	-	-	-	-	-	3	3	2
Avg.	3.0	2.8	2.0	2.0								3.0	2.8	3.0	2.7

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

UNIT I – BASIC CONCEPTS **9 hrs**

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Concept of Continuum, Comparison of microscopic and macroscopic approach, Path and point functions; intensive and extensive properties, specific quantities,; Heat and work transfer; Zeroth law of thermodynamics – concept of temperature and thermal equilibrium.

UNIT II – FIRST LAW OF THERMODYNAMICS **9 hrs**

Concept of energy and various forms of energy; specific heats; first law applied to elementary processes, closed systems and control volumes, steady and unsteady flow processes, internal energy, enthalpy

UNIT III – SECOND LAW OF THERMODYNAMICS **9 hrs**

Heat reservoir, Source and Sink; Heat Engine, Refrigerator and Heat Pump; Statement of second laws, Carnot cycle and Carnot principles/theorems, Clausius inequality, concept of entropy, entropy change for - pure substance, ideal gases, T-s diagrams; third law of thermodynamics, Availability and irreversibility

UNIT IV – THERMODYNAMICS CYCLES **9 hrs**

Air-standard Brayton cycle, Carnot vapor cycle, Rankine reheat cycle, ideal Rankine cycle, air-standard Otto cycle, air-standard Diesel cycle, vapor-compression refrigeration cycle

UNIT V – MARINE MACHINERIES **9 hrs**

Diesel Engines, Marine Auxiliary machineries and controls, Naval Architecture and Marine electrical machineries.

Total :45 Hrs

TEXT BOOKS

1. P.K. Nag , Engineering Thermodynamics, 6th edition, Tata McGraw-Hill, New Delhi, 2006.
2. Yunus Cengel and Michael Boles, Thermodynamics - An Engineering Approach, 28nd edition, Tata McGraw Hill Education, 2010.
3. HD McGeorge, MarineAuxiliary Machinery, 7th edition, Butterworth Heinemann Ltd., 2001.

REFERENCES

1. E.Natarajan, Engineering Thermodynamics: Fundamentals and Applications, 2nd edition, Anuragam Publications, 2012.
2. J.P.Holman, Thermodynamics, 4th edition, McGraw-Hill, 1987.
3. Ethirajan Rathakrishnan , Fundamentals of Engineering Thermodynamics, 2nd edition, Prentice-Hall of India Learning Pvt. Ltd, 2005.
4. P.Chattopadhyay, Engineering Thermodynamics, 2nd edition, Oxford University Press, 2016.

PROGRAM	B.E-Naval Architecture & Offshore Engineering				
Course Code: 232NA1A54TK	Course Name :	L	T	P	C
		3	1	0	4

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	STRENGTH OF SHIPS				
Year and Semester	III and V		**Contact hours per week**		
Prerequisite course	1. Strength of Materials 2. Marine Production technology		(3 Hrs)		
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
			✓		
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
Course Objective	To impart knowledge of various loads acting on ship structure, structural arrangement and structural response.				
Course Outcome	After completion of the course, the students will be able to 1. Explain types of loads on ship structure. 2. Estimate the section modulus and scantling. 3. Analyze ship structural components. 4. Apply structural design concepts to ship structure. 5. Estimate ship structural response. 6. Apply finite element method to ship structural analysis.				

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	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO6	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
AVERAGE	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1 – INTRODUCTION TO SHIP STRENGTH **9hrs**

Structural design concept; Various forces acting on ship structures in still water and waves: Loads, Weight and Weight distribution, Buoyancy and Buoyancy distribution; Load Curve, shear force curve, Bending moment curve, and deflection curve, wave bending curve.

UNIT 2 – STRENGTH OF HULL **9hrs**

Longitudinal strength: Hull as a girder; Section modulus calculation; Bending stress calculation; Shear stress distribution in cross section; Introduction to shear centre and torsion of hull; Testing of steels such as tensile test and impact test.

UNIT 3 – ANALYSIS OF STRUCTURAL COMPONENTS **9hrs**

Types of bulkheads and loads on bulkheads- Strength analysis of bulkheads. Types of foundations- load on foundations – Pile load test and Strength analysis. Generation of loads on superstructure; Grillage analysis, stiffened plate panels as open and closed grillage

UNIT 4 – SHIP STRUCTURAL DESIGN CONCEPTS **9hrs**

Specialization of ship structure, General considerations of external loads, design criteria steps in structural design procedure, design from first principles, structural design according to classification society rules, Working stress design (WSD), Load and resistance factor design (LRFD)

UNIT 5 – ADVANCED METHODS FOR SHIP STRUCTURAL ANALYSIS **9hrs**

Introduction to finite elements methods, application of finite element method, finite strip method

Total:45 Hrs

TEXT BOOKS

1. W. Muckle, Strength of Ships, 1st edition, Camelot Press Ltd, 1967.
2. Edward V. Lewis, Principles of Naval Architecture (Volume 2 - Resistance, Propulsion and Vibration), 3rd edition, SNAME, 1988.
3. Robert Taggart, Ship Design & Construction, SNAME, 1980.

REFERENCES

1. George J. Bruce and David J. Eyres ,Ship Construction, 7th edition, Butterworth Heinemann (Elsevier), 2012.
2. Alaa Mansour, Don Liu and J.Randolph Pauling, Principles of Naval Architecture Series: Strength of ships and ocean structures, 1st edition, SNAME, 2008.
3. Owen. F. Hughes and JeomKee Paik, Ship Structural Analysis and Design, , SNAME, 2008.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code **232NA1A54TN**	**Course Name** **SHIP RESISTANCE AND PROPULSION**	**L** **3**	**T** **0**	**P** **0**	**C** **3**
Year and Semester	III and V	**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**	

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Course Objectives	1. To impart knowledge of various methods of calculating ship resistance and powering. 2. To impart knowledge of various propulsion systems and their design.
Course Outcomes	After completion of the course, the students will be able to 1. Explain the basic concepts of fluid mechanics and its relevance with ship resistance and propulsion. 2. Classify the ship resistance components. 3. Estimate ship resistance using empirical methods and model test data. 4. Explain propeller theories used in propeller design. 5. Design propeller using K_T-K_Q-J charts. 6. Develop energy efficient hull forms and select the engine.

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

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

UNIT I – INTRODUCTION **9 hrs**

Basic of fluid mechanics, Laws of Similarity, Froude's Hypothesis, Laminar and turbulent flow, Components of ship resistance

UNIT II – COMPONENTS OF RESISTANCE **9 hrs**

Effect of roughness, Friction lines, Form resistance, Wave resistance, Kelvin wave pattern & wave generated by a ship. Air resistance, Appendage resistance, Resistance prediction methods

UNIT III – DETERMINATION OF RESISTANCE AND POWER **9 hrs**

Estimation of total resistance, Model experiment for resistance estimation of a ship, Estimation of effective power

UNIT IV – INTRODUCTION TO PROPULSION **9 hrs**

Types of propulsion, Screw propeller geometry, Propeller theories, Circulation theory, Blade elements theory. Laws of Similarity for propellers, Propeller in (open) water, Propeller coefficient

UNIT V – DESIGN OF PROPELLER **9 hrs**

Hull propeller interaction – wake, thrust deduction and relative rotative efficiency; propulsive efficiency and its components; propeller cavitation; propeller blade strength; Propeller design

Total:45 Hrs

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TEXT BOOKS

1. Edward V. Lewis, Principles of Naval Architecture (Vol. 2 - Resistance, Propulsion and Vibration), 3rd edition, SNAME, 1988.
2. E. C. Tupper, K. J. Rawson, Basic Ship Theory (Vol.1- Hydrostatics and Strength), 5th edition, Butterworth Heinemann (Elsevier), 2001.
3. E. C. Tupper, Introduction to Naval Architecture, 5th edition, Butterworth Heinemann (Elsevier), 2013.
4. J.P. Ghose and R.P. Gokarn, Basic Ship Propulsion, 1st Ed, Allied Publishers, 2004.

REFERENCES

1. S.A. Harvald, Resistance and propulsion of Ships, John Wiley & Sons Ltd, 1983.

<table>
<tr><td>PROGRAM</td><td colspan="5">B.E.-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
232NA1A54TO</td><td colspan="2">Course Name
SHIP CONSTRUCTION</td><td>L
3</td><td>T
0</td><td>P
0</td><td>C
3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">III and V</td><td colspan="3" rowspan="2">Contact hours per week
(3Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Introduction to Naval Architecture</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objectives</td><td colspan="6">1. To impart knowledge on processes involved in the ship fabrication and construction
2. To understand pipeline design and installation.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">After completion of the course, the students will be able to
1. Explain the various shipyard layout and the role of classification societies.
2. Classify and compare the material used for the vessel construction.
3. Demonstrate suitable storage, preparation and pre fabrication procedure.
4. Infer on the procedure of fabrication of sub assembly, units and hull erection.
5. Identify the various structural components in the ship.
6. Design the ship assembly, erection, outfitting, launching and sea trials.</td></tr>
</table>

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

UNIT I – SHIP BUILDING AND MATERIALS **9hrs**

A typical ship construction program, Building berth, Building Dock, Multi-stage construction methods Equipment used in building berths. Role of statutory bodies, Materials for ship construction, Structural steels, special steels, non- ferrous steels, non-metallic materials, material properties and testing of materials, Joining methods of materials.

UNIT II – STORAGE, PREPARATION AND PRE-FABRICATION **9hrs**

Material handling, levelling, preservation and storage, transport system in steel stockyard, material preparation devices- cleaning, marking processes, Process of prefabrication, welding in prefabrication and erection stages, The cutting process, Mechanical cutting, thermal cutting, optically and numerically controlled cutting, bending of rolled and built-up sections, plate bending. Nesting of plates.

UNIT III – FABRICATION OF SUB-ASSEMBLIES, UNITS AND HULL ERECTION 9hrs

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

UNIT IV – SHIP STRUCTURAL COMPONENTS **9hrs**

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

UNIT V– ASSEMBLY, ERECTION, OUTFITTING, LAUNCHING, TESTING AND TRIALS **9hrs**

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

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

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Total: 45 Hrs

TEXTBOOKS

1. Eyres.D.J, Bruce.G.J, Ship construction7th edition, Elsevier Publication, 2012.
2. Taylor,D.A, Merchant ship construction,1st edition, Butterworth-Heinemann, 1985.
3. John F Kemp, Peter Young, Ship construction sketches and notes, 2nd edition, Routledge, 2013.
4. Pursey,H.J, Merchant ship construction, 1st edition, Brown, son and Ferguson, Limited, 2008.

REFERENCES

1. The Maritime Engineering Reference Book, A Guide to Ship Design, Construction and Operation Editors: Anthony Molland
2. Thomas Lamb, Ship Design and Construction(Vol. 1 and 2), 1st , SNAME, 2004.

<table>
<tr><td>PROGRAM</td><td colspan="5">B.E.-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
232NA1A54TP</td><td colspan="2">Course Name
SHIP SYSTEMS ENGINEERING</td><td>L
3</td><td>T
0</td><td>P
0</td><td>C
3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">III and V</td><td colspan="3" rowspan="2">Contact hours per week
(3Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="6">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. To understand the components of ship systems and their layout.
2. To perform ship systems design calculations.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After completion of the course, the students will be able to
1. Explain the components involved in different ship systems.
2. Illustrate hull systems and their arrangements.
3. Outline the functions of engineering systems.
4. Explain firefighting system of the ship.
5. Illustrate propulsion and steering systems.
6. Select various types of ship systems.</td></tr>
</table>

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POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	-	2
CO2	2	2	-	-	-	-	-	-	-	-	-	2	3	-	2
CO3	2	2	-	-	-	2	-	-	-	-	-	2	3	-	2
CO4	2	2	-	-	-	2	2	-	-	-	-	2	3	-	2
CO5	2	2	-	-	-	-	2	-	-	-	-	2	3	-	2
CO6	2	2	-	-	-	-	2	-	-	-	2	2	3	-	2
Avg.	2.00	2.00	-	-	-	2.00	2.00	-	-	-	2.00	2.00	3.00	-	2.00

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

UNIT I – INTRODUCTION TO SHIP SYSTEMS **9 hrs**

Ship systems- piping system – types, color coding, valves - HVAC system, Mechanical system, Natural system- types of coolants, Grades of coolants, insulation, Flow measurements, Heat Load, Air changes, pneumatic system- basic function, types of valves, pneumatic/hydraulic system.

UNIT II – HULL SYSTEMS **9 hrs**

Fresh water system, -RO plant - hydrophore tank, Sanitary system- Sewage Treatment Plant (STP) - deck drains- ballast system and ballast water treatment- deck equipment's- anchor handling system- cargo handling equipment's,Liquid cargo handling system, Boat Davits, Deck cranes/derricks, anchor cables arrangement.

UNIT III – ENGINEERING SYSTEMS **9 hrs**

Fuel oil - lubrication oil,Oil properties - starting air compressed air - exhaust – boiler,Feed water system - jacket cooling - oil filters/strainers - oily water separator- scavenging and turbo charger - Anti-vibration - Types of machinery Shock mounts, Engine exhaust. Engine Room Ventilation,

UNIT IV – FIRE FIGHTING AND LIFE SAVING SYSTEMS **9 hrs**

Fire Fighting Appliance (FFA) – life saving appliances (LSA) - fire main system- CO_2 system- bilge system- sludge system,- deck sprinkler, IMO code

UNIT V – PROPULSION AND STEERING SYSTEM **9 hrs**

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

Total : 45 Hrs

TEXTBOOKS

1. G.O.Watson, Marine Electrical Practice, 6th edition, Butterworth- Heinemann (Elsevier),

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2014.
2. Harrington L.Roy, Marine Engineering, 1st edition, SNAME, 1992.
3. Chirstopher Lavers and Edmund G.R. Kraal, Advanced Electro technology for marine engineers, 2nd edition, Reed's Vol.7, 2014.

REFERENCES

1. E. A. Fernandez, Marine Electrical Technology, 7th edition, Shroff Publishers, 2014.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	**L**	**T**	**P**	**C**
232NA1A64TQ	DESIGN OF OFFSHORE STRUCTURES	**3**	**1**	**0**	**4**
Year and Semester	III and VI	**Contact hours per week** (4 Hrs)			
Prerequisite course	NIL				

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

Course Objectives	To understand types of offshore structures, submarine pipelines under static and dynamic loads.
Course Outcomes	After completion of the course, the students will be able to 1. Explain types and design of offshore structures. 2. Design the structure for static and dynamic loads. 3. Design structure against accidental loading. 4. Analyse stability of submarine pipelines. 5. Design of floating structures and compliant structures. 6. Estimate fatigue life of offshore structures.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO6	3	3	3	2	3	3	2	-	2	-	-	2	3	3	2
Avg.	3	3	3	2	3	3	2	-	2	-	-	2	3	3	2.0

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

UNITI – DESIGN PRINCIPLES AND METHODS **9hrs**

Introduction - Types of offshore structures and structural components, Planning of Offshore Structures; Design criteria and procedures. Loads on offshore structures. Calculation based on

Maximum base Shear and Overturning Moments. Design Wave approach

UNIT II – DESIGN FOR STATIC AND DYNAMIC LOADS **9 hrs**

Design of jacket structure against wave loading - Design for combined stresses as per API RP 2A guidelines. Simple tubular joints, design using allowable loads; Fatigue -stress concentration factors; S-N curves and fatigue damage calculations

UNITIII – DESIGN FOR ACCIDENT ALLOADING **9 hrs**

Design against accidental loading (Fire, blast and collision), Behavior of steel at elevated temperature; Design of structures for high temperature: Collision of Boats and Energy Absorption. Plastic design method

UNIT IV– DESIGN OF PIPELINES **9 hrs**

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

UNITV– DESIGN OF FLOATING STRUCTURES **9 hrs**

Design criteria, Tension leg platforms; Tethers selection and design; Spar hulls; classic, truss and cell spar; Spar hull compartments and design of shell structures; Decommissioning of offshore platforms

Total: 45 Hrs

TEXTBOOKS

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 Structures Vol.1 &2, Kreiger Publ.Co.1991.
6. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
7. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.

REFERENCES

1. Srinivasan Chandrasekaran, Dynamic Analysis and Design of Ocean Structures. Springer, 2015.
2. DNV-RP-C203- fatigue Design of Offshore Steel Structures, 2011.
3. Clauss, G, Lehmann, E &Ostergaard, C, Offshore Structures, Vol. 1 & 2, Springer-Verlag, 1992.
4. Reddy, D. V and Arockiasamy, M., Offshore Structures Vol.1 & 2, Kreiger Publ. Co.1991
5. API RP 2A. Planning, Designing and Constructing Fixed Offshore Platforms, API. 2000.

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PROGRAM	B.E-Naval Architecture & Offshore Engineering				
Course Code: 232NA1A64TR	Course Name: SHIP MOTION AND CONTROL	L: 3	T: 0	P: 0	C: 3
Year and Semester	III and VI	Contact hours per week (3Hrs)			
Prerequisite course	Marine Hydrodynamics				
Course category	Humanities and Social Sciences	Management courses	Professional Core: ✓	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	To understand the motion characteristics and their dynamic effects of ships in waves.				
Course Outcome	After completion of the course, the students will be able to 1. Evaluate analytically the seakeeping analysis for 1-DOF. 2. Estimate the ship response spectrum in random waves. 3. Explain the dynamic effects due to ship motions and their influence in ship design 4. Interpret control fixed stability of surface ships and the linear hydrodynamic derivatives for maneuvering. 5. Examine standard maneuvers and determine the hydrodynamic derivatives through experiments. 6. Discuss the hydrodynamics associated with rudder selection and its design aspect.				

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

UNIT I – INTRODUCTION TO SEAKEEPING **9 hrs**

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

UNIT II – SHIP MOTIONS IN REGULAR WAVES 9 hrs

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

UNIT III – SHIP MOTIONS IN IRREGULAR WAVES AND DYNAMIC EFFECTS

9 hrs

Ship motions in irregular waves, Response spectra, Dynamic effects; deck wetness, slamming,relative motions, motion sickness, added resistance and loss of ship speed in seaway, Polar diagram, Design considerations for sea keeping, comfort class, Motion stabilizers.

UNIT IV – MANEUVERING CHARACTERISTICS OF SURFACE SHIP 9 hrs

Introduction to manoeuvrability, Types of directional stability, linear equations of motions in horizontal plane, hydrodynamic and control derivatives, stability index, standard manoeuvres; turning circle

UNIT V – STANDARD MANEUVERS AND RUDDER CHARACTERISTICS 9 hrs

Experimental determination of hydrodynamic derivatives; straight-line, rotating arm and PMMexperiments, IMO Guidelines, Estimation of maneuverability in ship design, standards for ship maneuverability, Maneuvering in shallow water; Squat, Bank Cushion effect, Interaction between ships, Control surface – Rudder and their types, hydrodynamic constraints in rudder design.

Total:45 Hrs

TEXT BOOKS

1. Rameshwar Bhattacharya, Dynamics of Marine Vehicles, John Wiley & Sons Ltd, 1972.
4. Edward V. Lewis, Principles of Naval Architecture (Vol. 3 - Motions in waves and controllability), 3rd edition, SNAME, 1988.
5. Ben C. Gerwick Jr., Construction of Marine and Offshore Structures, 3rd edition, CRC Press., 2007.

REFERENCES

1. J M J Journee & Jacob Pinkster, Introduction in Ship Hydrodynamics Delft University of Technology,2002.
2. A R J M Lloyd ,Seakeeping: Ship Behaviour in Rough Weather,Ellis Horwood, United Kingdom,1989.

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code: 232NA1A64TS	**Course Name**	**L**	**T**	**P**	**C**
	SHIP DESIGN	**3**	**0**	**0**	**3**
Year and Semester	III and VI	**Contact hours per week** (3Hrs)			
Prerequisite course	1. Theory of ships 2. Ship Resistance and Propulsion				

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

Course Objectives	To understand ship design process and hullform design.
Course Outcomes	After completion of the course, the students will be able to 1. Explain the ship design as both science and art and outline the various constraints in the ship design process. 2. Plan the ship design activity using design spiral based on owner's requirements 3. Select the principal dimensions and form coefficients. 4. Select the stem and stern profiles. 5. Design the general arrangement plans. 6. Develop the hullform from the first principles.

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
CO2	3	3	3	3	3	-	-	3	-	-	-	-	3	3	3
CO3	3	3	3	3	3	-	-	3	-	-	3	3	3	3	3
CO4	3	3	3	3	3	-	-	3	-	-	3	3	3	3	3
CO5	3	3	3	3	3	-	-	3	-	-	3	3	3	3	3
CO6	3	3	3	3	3	-	-	3	-	-	3	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CORRELATION LEVELS		1. SLIGHT (LOW)				2. MODERATE (MEDIUM)					3. SUBSTANTIAL (HIGH)				

UNIT I – DESIGN PHILOSOPHY **9hrs**

Ship design as a science and as an art; Manufacturing and operational considerations in Ship design, Technological and economical factors, National and Global priorities.

UNIT II – DESIGN CONSIDERATION OF SHIPS **9hrs**

Owner's requirements, Technical specification and ship building contract procedures, shipyard production facilities and operational constraints to be considered in the design process, Ship design method using basis ship, design spiral.

UNIT III – SELECTION OF DIMENSIONS AND COEFFICIENTS **9hrs**

Selection of main dimensions -Initial Sizing, Selection of Hull Form Coefficients, Determination of the main dimensions – Methods, Rationalization of dimensions

UNIT IV – DESIGN OF HULL FORMS **9hrs**

Sectional Area Curve and factors affecting sectional area curve, Section Shape, midship section, Stem and Stern profiles, Types of bow, bulbous bow, parabolic bow, Form of stern; Elliptical, Cruiser Stern , Transom Stern, Hull forms of ships (Bulk Carrier, Tanker, Container ships, etc)

UNIT V – GENERAL ARRANGEMENT AND DISPOSITION OF WEIGHTS **9hrs**

Preliminary General arrangement, calculations of weight, volume and capacity using empirical formulae.

Total:45 Hrs

TEXT BOOKS

1. Apostolos Papanikolaou, Ship Design: Methodologies of Preliminary Design, Springer, 2014.
2. D.G.M Watson, Practical Ship Design, 1st, Elsevier Science Ltd., 1998.
3. H.Schneekluth and V.Bertram, Ship Design for Efficiency and Economy, 2nd, Butterworth Heinemann (Elsevier), 1998.
4. Robert Taggart, Ship Design & Construction, SNAME, 1980.

REFERENCES

1. E. C. Tupper, K. J. Rawson, Basic Ship Theory (Vol.1- Hydrostatics and Strength), 5th edition, Butterworth-Heinemann (Elsevier), 2001.
2. Edward V. Lewis, Principles of Naval Architecture (Vol. 1 - Stability and Strength), 3rd edition, SNAME, 1988.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	**L**	**T**	**P**	**C**	
232NA1A34PC	**SHIP DRAWING - LINES PLAN**	**0**	**0**	**4**	**2**	
Year and Semester	I and II	**Contact hours per week** (4Hrs)				
Prerequisite course	Nil					

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

Course Objectives	To draw lines plan of a vessel manually and also using CAD software
Course Outcomes	After completion of the course, the students will be able to 1. Develop the lines plan manually using BSRA Series 2. Build the faired offset table manually 3. Explain the basic commands of Auto CAD software 4. Create CAD drawing of lines plan. 5. Estimate the waterplane area at various drafts. 6. Develop the bonjean curves.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	-	2	-	-	-	3	3	3
CO2	3	-	3	-	-	-	-	-	2	-	-	-	3	3	3
CO3	3	-	-	-	3	-	-	-	2	-	-	2	3	3	3
CO4	3	-	3	-	3	-	-	-	2	-	-	2	3	3	3
CO5	3	-	3	-	-	-	-	-	2	-	-	-	3	3	3
CO6	3	-	3	-	-	-	-	-	2	-	-	-	3	3	3
Avg.	3.00	-	3.00	-	3.00	-	-	-	2.00	-	-	2.00	3.00	3.00	3.00

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

LIST OF EXERCISES

1. Drawing lines plan manually using the derived offset table.
2. Deriving the Faired, Offset table
3. Basic CAD commands, drawing of lines plan in CAD software.
4. Drawing lines plan using AUTOCAD with the derived offset table.
5. Estimate the waterplane area at various drafts.
6. Develop the bonjean curves for a given ship. **Total : 30 Hrs**

TEXTBOOKS

1. Edward V. Lewis, Principles of Naval Architecture, Vol. 1 - Stability and Strength, 3rd edition, SNAME, 1988.
2. E. C. Tupper and K. J. Rawson, Basic Ship Theory(Vol. 2- Ship Dynamics and Design), 5th edition, Butterworth-Heinemann, 2001.
3. John S.Letcher Jr, J.Randolph Pauling, The Principles of Naval Architecture Series, SNAME, 2009.

REFERENCES

1. Robert Taggart, Ship Design & Construction, SNAME, 1980.
2. D.G.M Watson, Practical ship design, 1st edition, Elsevier Science Ltd., 1998.

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code 232NA1A34PF	Course Name HYDROSTATICS & STABILITY LABORATORY	L 0	T 0	P 2	C 1
Year and Semester	II and III	Contact hours per week (2Hrs)			
Prerequisite course	Introduction to Naval Architecture				

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

Course Objectives	To perform hydrostatic calculations & initial stability calculations, and surface area calculation
Course Outcomes	After completion of the course, the students will be able to 1. Estimate various hydrostatic parameters using software 2. Develop the hydrostatic curves from the calculated values. 3. Construct the hydrostatic table using manual calculation. 4. Explain the intact stability requirement. 5. Estimate the initial stability of a vessel for various loading conditions. 6. Evaluate wetted surface area and paint surface area.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	-	-	-	-	-	2	3	2	2	2
CO2	3	3	2	2	2	-	-	-	-	-	2	2	2	2	2
CO3	3	3	2	2	2	-	-	-	-	-	2	2	2	2	2
CO4	3	2	-	-	2	-	-	-	-	-	2	-	2	2	2
CO5	3	3	2	2	3	-	-	-	-	-	2	2	2	2	2
CO6	3	3	2	2	3	-	-	-	-	-	2	2	2	2	2
Avg.	3.00	2.85	2.00	2.00	2.50	-	-	-	-	-	2.00	2.20	2.00	2.00	2.00

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

LIST OF ASSIGNMENTS

1. Estimate the hydrostatic parameters for the given vessel using the software**.**
2. Estimate the hydrostatic parameters for the given vessel manually

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3. Compare the values calculated through the different numerical integration techniques.
4. Draw the GZ curves of the given vessel with different loading condition
5. Calculate the wetted surface area for the given ship.
6. Estimate the painted area of the given vessel.
7. Estimate the waterplane area and centroid of given offset of waterplane.
8. Verify the IMO requirement of GZ curve of given vessel.

Total: 30 Hrs

TEXTBOOKS

1. Edward V Lewis, Principle of Naval Architecture-Vol.1, SNAME, 1988.
2. Adrian Biran Rubén López-Pulido, Ship Hydrostatics & Stability, 2nd edition, Butterworth-Heinemann, 2013.

REFERENCES

1. E C Tupper, Introduction to Naval Architecture, Butterworth-Heinemann, 2004.
2. Edward Alan Stokoe and Richard Pemberton, Naval Architecture for Marine Engineers-Vol.IV-5th edition, Reeds, 2018.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code **232NA1A34PG**	**Course Name** **SURFACE MODELLING AND ANALYSIS - SOFTWARE LABORATORY**			**L**	**T**	**P**	**C**
				0	**0**	**2**	**1**
Year and Semester	II and III		**Contact hours per week** (2Hrs)				
Prerequisite course	Ship drawing – Lines plan						
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 surface generation and modelling techniques for ships using an appropriate Software and to carry out hydrostatic analysis.						

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Course Outcomes	After completion of the course, the students will be able to 1. List various options available in the software to model the ship hull. 2. Explain the capabilities of the software and familiarization with graphical user interface. 3. Prepare the basic setting required for the software and import required inputs and other plugins. 4. Demonstrate point and surface generation for the given ship hull. 5. Create a 3D faired ship model in the software. 6. Compare the results of manual hydrostatics with the software output.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	3	-	-	-	-	-	-	-	2	3	3
CO2	-	-	2	-	3	-	-	-	-	-	-	-	2	2	2
CO3	-	-	2	3	3	-	-	-	-	-	-	-	2	2	2
CO4	-	-	3	2	3	-	-	-	-	-	-	-	2	2	2
CO5	-	-	3	2	3	-	-	-	-	-	-	2	3	3	3
CO6	2	2	-	3	2	-	-	-	-	-	-	2	2	3	3
Avg.	2.00	2.00	2.50	2.50	2.83	-	-	-	-	-	-	2.00	2.33	2.50	2.50

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

LIST OF TASKS

LAB TASK 1:

Introduction to the software and its capabilities, Familiarization with the GUI, entering/importing coordinates for the given vessel, 2D commands and drawings

LAB TASK 2:

Working with the curves, curve types, operations and properties in relevance with vessel modelling

LAB TASK 3:

Surface operations, surface creations, trimming and bonding surfaces, working with control points

LAB TASK 4:

working with surfaces, surface types and properties, rendering the surface

LAB TASK 5:

Calculations – Hydrostatics, Girth and Areas

Total: 30 Hrs

TEXTBOOKS

1. Tian Xiang Yue, Surface Modeling: High Accuracy and High-Speed Methods, 1st edition, CRC Press, 2017.

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

2. K.J Rawson & E.C Tupper, Basic Ship Theory, 1st edition, Longman Sc & Tech, 1983.

REFERENCES

1. Software manual

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	**L**	**T**	**P**	**C**
232NA1A54PL	**SHIP STRENGTH LABORATORY**	**0**	**0**	**2**	**1**
Year and Semester	II and 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 Objectives	To study &execute the GA plan, Longitudinal strength and midship section modulus of ship based on classification rules.
Course Outcomes	After completion of the course, the students will be able to 1. Develop the General Arrangement of ship 2. Evaluate the Longitudinal strength for various loading conditions 3. Prepare the Scantlings calculation for various structural components 4. Estimate the Section modulus based on classification rules 5. Evaluate the strength of mid-ship section 6. Execute the mid-ship section drawing in software.

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

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

LIST OF TASKS

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GENERAL ARRANGEMENT OF SHIP

- General arrangement of ship as per the classification society rules and other rules
- Drawing in CAD Software:
- Arrangement of Engine Room
- Capacity calculations
- Arrangement of accommodation
- Arrangement of Superstructure

LONGITUDINAL SHIP STRENGTH

Ship in calm water, wave bending. Weight curve, buoyancy curve, shear force & bending moment calculations and diagram.

SCANTLING

Scantling calculations and Drawing of Mid ship Section, as per Classification Rules

Total : 30Hrs

TEXTBOOKS

1. Muckle.W, Strength of Ships,First Edition, 1967, Edward Arnold
2. Lewis, E U. Principles of Naval Architecture (2nd Rev) Vol II 1989 SNAME, New York,
3. Taggart R, Ship Design and Construction, SNAME, New York, 1980

REFERENCES

1. Mechanics of Materials, James M. Gere, Stephon P. Timoshenko
2. Ship Construction by D.J.Eyres Merchant Ship Construction by D.A.Taylor
3. Alaa Mansour, Don Liu, Principles of Naval Architecture Series: Strength of ships and ocean structures, SNAME, New Jersey, 2008.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code **232NA1A64PT**	**Course Name** **MARINE HYDRODYNAMICS LABORATORY**			**L** **0**	**T** **0**	**P** **2**	**C** **1**
Year and Semester	III and VI		**Contact hours per week** (2Hrs)			
Prerequisite course	Marine Hydrodynamics/Ship resistance and Propulsion					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**		
			✓			
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**		

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Course Objectives	To understand the experimental techniques in the model making and carry out the basic model tests involved in ship hydrodynamics.			
Course Outcomes	After completion of the course, the students will be able to 1. Prepare the ship model through model making techniques. 2. Evaluate center of gravity of a ship model. 3. Determine ship stability through inclining experiment. 4. Estimate the radius of gyration to facilitate ship motion studies. 5. Demonstrate model preparation using ballast weights. 6. Predict ship resistance using ITTC method.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	2	2	2	3	2	2	-	3	2	2
CO2	2	2	3	2	3	2	2	2	3	2	-	-	3	2	2
CO3	2	2	3	2	3	2	2	2	3	2	-	-	3	2	2
CO4	2	2	3	2	3	2	2	2	3	2	2	-	3	2	2
CO5	2	2	3	2	3	2	2	2	3	2	2	-	3	2	2
CO6	2	2	3	2	3	2	2	2	3	2	-	-	3	2	2
Avg.	2.00	2.00	3.00	2.00	3.00	-	-	2.00	3.00	2.00	2.00	-	3.00	2.00	2.00

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

LIST OF TASKS

Lab Task 1:

Model Making Techniques

Lab Task 2:

Calibration of instruments.

Lab Task 3:

Analyzing the geometrically similar ship model, determination of CG of the Ship model.

Lab Task 4:

Inclining Experiment..

Lab Task 5:

ITTC standards of model tests, Method of ITTC 1978 resistance prediction method.

Lab Task 6:

Model preparation for resistance and sea keeping tests.

Total: 30 Hrs

TEXT BOOKS

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

1. Volker Bertram, Practical Ship Hydrodynamics, 1st edition, Butterworth- Heinemann (Elsevier), 2000.
2. Rameshwar Bhattacharya, Dynamics of Marine Vehicles, 1st edition, John Wiley and Sons Ltd, 1972.

REFERENCES

1. Hermans A.J., Water waves and ship hydrodynamics, 2nd edition, Springer, 2011.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code **232NA1A64PU**	**Course Name** **OFFSHORE STRUCTURE DESIGN – SOFTWARE LABORATORY**			**L**	**T**	**P**	**C**
				0	**0**	**2**	**1**
Year and Semester	III and 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 Objectives	To create and analyze various models of offshore structures using modelling software.					
Course Outcomes	After completion of the course, the students will be able to 1. Create model of the given Jacket platform in software. 2. Analyze the structure under various conditions. 3. Analyze the structure under various loads. 4. Evaluate suitable conditions to geometrically frame jacket platform. 5. Create a semisubmersible with topside. 6. Develop the design of offshore structures.					

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	2	2	-	-	2	2	2	2	2	2	2	2
CO2	2	-	2	2	2	2	-	2	-	-	2	-	3	3	3
CO3	2	-	2	2	2	2	-	2	-	-	2	-	3	3	3
CO4	-	-	-	2	2	2	-	2	2	2	2	-	3	3	3
CO5	-	-	-	2	2	2	-	2	2	2	3	2	3	3	3
CO6	-	-	-	3	3	3	3	3	3	3	3	3	3	3	3
Avg.	2.00	2.00	2.00	2.16	2.16	2.20	3.00	2.16	2.25	2.25	2.16	2.30	2.80	2.80	2.80
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)					

UNIT – I **6 Hrs**

Brief introduction to Offshore structure design principles and calculations – Overview of Structural Analysis and Design Software (SACS), Finite Element Analysis Software (ANSYS), Marine Operations Simulation Environment (MOSES), Structural Analysis and Design Software (STAAD.Pro), Abaqus.Familiarization with software and GUI.

UNIT – II **6 Hrs**

Introduction to the Jacket Structure modelling – Structural analysis of the structure - Creation of sections – selection of materials and thickness of the plates.

UNIT – III **6 Hrs**

Creation of bottom structure like legs – horizontal bracings, vertical bracings, risers, conductors and stubs. Creation of wind loads and displacement loads – Analysing the structure by using linear structural analysis method.

UNIT – IV **6 Hrs**

Creation of top structure using I-sections and plates stiffeners, girders and decks and placing equipment like generator, crane, blankets on the deck.

UNIT – V **6 Hrs**

Collaborate in a team environment to solve complex offshore engineering challenges.

Develop communication skills by presenting and documenting design processes and outcomes.

Total:30 Hrs

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TEXT BOOKS:

1. Software modules by DNV GL SESAM (Genie v7.1)
2. WAMIT manual.

REFERENCES:

1. Software modules by DNV GL SESAM (Genie v7.1)

<table>
<tr><td>PROGRAM</td><td colspan="6">B.E.-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
232NA1A54PM</td><td colspan="3">Course Name
STRUCTURAL MODELLING & ANALYSIS SOFTWARE LAB</td><td>L
0</td><td>T
0</td><td>P
2</td><td>C
1</td></tr>
<tr><td>Year and Semester</td><td colspan="2">III and V</td><td colspan="4" rowspan="2">Contact hours per week
(2Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Ship Drawing-Lines Plan</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="4">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="4"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="4">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="4"></td></tr>
<tr><td>Course Objectives</td><td colspan="6">To perform the general arrangement and strength of the ship.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">After completion of the course, the students will be able to
1. List the background of the software.
2. Develop modelling skills using software.
3. Create a ship model to execute analysis.
4. Evaluate the strength analysis using the software.
5. Evaluate 2D stress distribution using the software.
6. Analyze the uniform beams subjected to loads.</td></tr>
</table>

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	2	2	-
CO2	3	3	3	2	2	-	-	-	2	-	2	-	2	2	-
CO3	3	3	3	-	2	-	-	-	2	-	2	-	2	2	2
CO4	3	3	3	2	2	-	-	-	2	-	2	-	2	2	2
CO5	3	3	3	2	2	-	-	-	2	-	2	2	2	2	2
CO6	3	3	3	2	2	-	-	-	2	-	2	2	2	2	3
Avg.	3.00	3.00	3.00	2.00	2.00	-	-	-	2.00	-	2.00	2.00	2.00	2.00	2.00

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

LIST OF TASKS

- Basic understanding of the software GUI
- Modelling of the ship geometry and meshing process
- Compartmentation
- Structural Strength in different loading condition
- FEA Practice – Modelling and meshing, Analysis of 2D stress distribution
- Analysis of uniform beams subjected to distributed and point loads
- Developing Modeling and Analysis Process

Total : 30 Hrs

TEXTBOOKS

1. Software manual
2. Robert Taggart, Ship Design & Construction, SNAME, 1980.

REFERENCES

1. Edward V Lewis, Principles of Naval Architecture, 2nd edition, SNAME, 1988.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	**L**	**T**	**P**	**C**
232NA1A64PV	**SHIP SYSTEM DRAWING LABORATORY**	**0**	**0**	**2**	**1**
Year and Semester	III and VI	**Contact hours per week** (2Hrs)			
Prerequisite course	Nil				

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

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

Course Objectives	To develop the various tanks, system arrangements and launching calculation
Course Outcomes	After completion of the course, the students will be able to 1. Identify & calculate the various tank used in double bottom. 2. Design the bilge and ballast system. 3. Construct the various fuel oil, lub oil and water systems used in ship. 4. Develop the various fire and safety plans. 5. Perform the launching plan and its calculations. 6. Develop various ship system plans used in ship.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	2	-	-	2	2	2	2	-	2	2	2
CO2	2	2	2	-	-	-	-	2	2	2	2	-	2	2	2
CO3	2	2	2	-	-	2	2	-	2	2	2	-	2	2	2
CO4	2	3	3	-	2	2	2	2	3	3	2	2	2	2	3
CO5	3	3	3	2	2	-	-	2	3	2	-	2	2	3	3
CO6	3	2	3	2	2	-	-	2	2	-	-	2	2	3	3
Avg.	2.33	2.33	2.50	2.00	2.00	2.00	2.00	2.00	2.33	2.20	2.00	2.00	2.00	2.33	2.50

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

LIST OF TASKS

1. Capacity Calculations and its arrangements
2. Bilge and Ballast water system
3. Fuel Oil, Lub oil and Domestic water system
4. Fire Protection &Life Saving Arrangements.
5. Launching Calculation.

Total:

30 Hrs

TEXT BOOKS:

1. George J. Bruce, David J. Eyres , Ship Construction, 7th edition, Butterworth-Heinemann(Elsevier), 2012.
2. D A Taylor, Merchant ship construction , 3rd edition , The Institute of Marine Engineers, 1992.

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

3. Kemp, Young, David J.Eyres, Ship Construction Sketches and notes, 2nd edition, Butterworth-Heinemann, 1997.
4. H.J. Pursey, Merchant Ship Construction, 7th Edition, Brown Son & Ferguson Ltd, Nautical Publishers, 1994.

REFERENCES:

1. Robert Taggart, Ship Design & Construction, , 1st edition, SNAME, 1980.
2. E. C. Tupper, Introduction to Naval Architecture, 5th edition, Butterworth-Heinemann (Elsevier), 2013.
3. Edward V. Lewis, Principles of Naval Architecture (Vol. 3 - Motions in waves and controllability), 3rd edition, SNAME, U.S.A, 1988.

<table>
<tr><td>PROGRAM</td><td colspan="5">B.E.-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
232NA1A84PW</td><td colspan="2">Course Name
NUMERICAL SHIP HYDRODYNAMICS SOFTWARE LABORATORY</td><td>L
0</td><td>T
0</td><td>P
2</td><td>C
1</td></tr>
<tr><td>Year and Semester</td><td colspan="2">IV and VII</td><td colspan="4" rowspan="2">Contact hours per week
(2Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Engineering Fluid Mechanics/Marine Hydrodynamics</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objectives</td><td colspan="6">To learn and practice the computational method to estimate and analyze the ship hydrodynamic problems.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">After completion of the course, the students will be able to
1. List the general capabilities of the software and familiarize with the graphical user interface.
2. Prepare the 3D model of a ship and import to the software.
3. Create a computational virtual towing tank of appropriate dimensions.
4. Create an appropriate meshing strategy for the given problem
5. Estimate the ship resistance and compare with the literature values.
6. Predict the propeller characteristics and ship motion in waves using the software.</td></tr>
</table>

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POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	2	2	-	2	2	-	2	2	2	2
CO2	2	2	3	2	3	2	2	-	2	2	2	2	2	2	2
CO3	2	2	3	2	3	2	2	-	2	2	2	2	2	2	2
CO4	2	2	3	2	3	2	2	-	2	2	-	-	2	2	2
CO5	2	2	3	2	3	2	2	-	2	2	2	2	2	2	2
CO6	2	2	3	2	3	2	2	-	2	2	2	2	2	2	2
Avg.	2.00	2.00	3.00	2.00	3.00	2.00	2.00	-	2.00	2.00	2.00	2.00	2.00	2.00	2.00

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

UNIT – I **6 Hrs**

Introduction to the software and its capabilities, General overview of CFD process and its application in ship hydrodynamics. Familiarization with the GUI, Importing the CAD model, generation of Virtual Towing Tank, applying boundary conditions, analyzing the domain.

UNIT – II **6 Hrs**

Meshing strategies, Meshing the model, free surface capturing, Volume meshing, applying mesh, Setting solver parameters, Scene creation for visualization of flow, post processing the results, Comparing the results with literature

UNIT – III **6 Hrs**

Numerical simulation for open water, computational set-up, meshing and visualizing.

2D study of flow around cylinder, flat plate.

UNIT – IV **6 Hrs**

2D study of flow around airfoil.

Resistance prediction of KCS.

UNIT – V **6 Hrs**

Numerical simulation for ship in waves – head sea condition, computational set-up, meshing and visualization

Total: 30 Hrs

TEXT BOOKS:

1. WS Atkins, Consultants and Members of the NSC, Best practice guidelines for marine applications of computational fluid dynamics, 2003.
2. H. Versteeg and W. Malalasekera, An introduction to computational fluid dynamics: The finite volume method, Printice Hall, 2nd edition, 2007.

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

REFERENCES:

1. John D. Anderson, Computational Fluid Dynamics: The basics with applications, 1995.

2. Software manual.

PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code	Course Name	L	T	P	C
232NA1A55TA	MARINE ENGINEERING-I	3	0	0	3
Year and Semester		Contact hours per week (3 Hrs)			
Prerequisite course	Thermodynamics & Marine Machinery				

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

Course Objectives	The main objective of the course is to impart knowledge on operations of marine machinery and auxiliary systems
Course Outcomes	After completion of the course, the students will be able to: 1. Demonstrate the ship machinery, Engine selection, and their working principle. 2. Illustrate the engine room arrangement and mountings. 3. Explain marine boiler systems and operation 4. Explain the marine steam turbines and operation 5. Estimate the refrigeration unit requirements in ships 6. Identify the main machinery and auxiliary systems which are used in ships

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	2	-	-	-	-	-	2	2	-
CO2	3	-	-	-	2	3	2	-	-	-	-	-	2	2	-
CO3	3	-	_	-	2	-	-	-	-	-	-	-	2	2	-
CO4	3	-	-	-	2	-	-	-	-	-	-	-	2	2	-
CO5	3	3	3	-	2	-	2	-	-	-	-	-	2	2	-
CO6	3	-	-	-	2	-	-	-	-	-	-	-	2	2	-
Avg.	3	3	3	-	2	3	2	-	-	-	-	-	2	2	-

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

UNIT I – SHIP MACHINERY **9hrs**

Ships and machinery - design and selection considerations; 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

UNIT II – ENGINE ROOM **9 hrs**

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 mounting, combustion, feed system, deaerators, boiler operation, coal fired boilers

UNIT IV – TURBINE **9 hrs**

Marine Steam turbines - Types of turbines, compounding - reheat turbines, turbine construction, rotors, blades, casing, Gland sealing, diaphrams, nozzles, bearings, etc.

UNIT V – REFRIGERATION **9 hrs**

Air -Conditioning and Refrigeration, – psychrometric properties of air- Psychrometric chart – Adiabatic saturation. Psychrometric process Sensible heating and cooling, Cooling and dehumidification-heating and humidification, Heating and dehumidification

Total: 45 Hours

TEXTBOOKS:

1. Harrington L.(1992), Marine Engineering, Society of Naval Architects and Marine Engineers.
2. Malcolm Latarche (2020), Pounder's Marine Diesel Engines and Gas Turbines-10th edition, Butterworth-Heinemann.
3. Mc George. H.D(1991), General Engineering Knowledge-3ed edition, Routledge Publications.
4. Mc George. H.D(1998), Marine Auxiliary Machinery-7th edition, Butterworth-Heinemann.
5. Flanagan.G.T.H (1990),Marine Boilers-3ed edition, Butterworth-Heinemann.

REFERENCES:

1. Anthony F.Molland (2008), The Maritime Engineering Reference Book, Butterworth-Heinemann.
2. Taylor, D.A.(1996), Introduction to Marine Engineering-2ed edition, Butterworth-Heinemann.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
232NA1A65TB	**MARINE POLLUTION**	3	0	0	3

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Year and 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	The main objective of the course is to impart knowledge on the classification of marine pollution, measures to mitigate marine pollution and impact of pollution.			
Course Outcomes	After completion of the course, the students will be able to 1. Classify the types of pollution and its effects 2. Demonstrate the key provisions of the law of sea. 3. Apply measures and understand the requirement of pollution from oil and harmful substances. 4. Assess the prevention of pollution from sewage and garbage. 5. Evaluate the air pollution from ships during the initial phase of design. 6. Improve the learning for a safe and sound design of ships			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO6	3	-	2	-	-	-	3	-	-	-	-	-	-	-	-
Avg.	3	-	2	-	-	-	3	-	-	-	-	-	-	-	-

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

UNIT I – POLLUTANTS IN MARINE ENVIRONMENT **9 hrs**

Definition of marine pollution. Sources- discharges to estuaries, marine debris, heavy metal pollution, oil and thermal pollution. Marine pollution monitoring and abatement programs.

UNIT II –THE LAW OF THE SEA **9 hrs**

The oceans – Maritime zones; Need for marine environment protection. The law of the sea and marine pollution – Navigation, exclusive economic zone, continental shelf, deep seabed mining, exploitation regime, marine scientific research.

UNIT III – OIL POLLUTION **9 hrs**

Oil Pollution-Sources of oil pollution-environmental impact of oil pollution- -commercial damage from oil pollution. Prevention & Treatment of oil pollution – operational measures and accidental discharges; Double hulls standards

UNIT IV – POLLUTION BY HARMFUL SUBSTANCES **9 hrs**

Sources of harmful substances like Mercury, Cadmium, etc. Trace metals as pollutants. Remediation and prevention measure for harmful substances. Introduction to International Maritime Dangerous Goods Code (IMDG code). Measures for dumping the garbage-Disposal of all form of plastics into sea.

UNIT V – PREVENTION OF AIR POLLUTION FROM SHIPS **9 hrs**

Limits on Sulphur oxide and Nitrogen oxide emissions from ship exhausts; Designated emission control areas; Stringent standards for SOx, NOx and particulate matter; Mandatory technical and operational energy efficiency measures.

Total: 45 Hours

TEXT BOOKS:

1. R.B., Clark, ― Marine Pollution‖, Fifth Edition, Published By Oxford University Press, Newyork, US, 2011
2. International Maritime Organization (IMO) conventions, International Convention for the Prevention of Pollution from Ships (MARPOL), United Kingdom, 2005.
3. United Nations, United Nations Convention on the Law of the Sea, New York.
4. J.W. Doerffer, Oil Spill Response in the Marine Environment,Pergamon Press, 1992, ISBN 0-08-041000-6.

REFERENCES:

1. John H. Bates, UK Marine Pollution Law, Lloyd's of London Press, 1985, ISBN 1-85044-028-X.
2. Ricardo Beiras, Marine Pollution–Sources, Fate and Effects of Pollutants in Coastal Ecosystems, Elsevier, 2018.
3. R.B. Clark, C. Frid and M Atttrill, Marine Pollution, 4th Edition, Oxford Science Publications, 1997, ISBN 0-19-850069-6.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
232NA1A75TC	**MARINE ENGINEERING-II**	3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)			

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Prerequisite course	Thermodynamics & Marine Machinery			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
				✓
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
Course Objectives	The students would learn the details regarding marine pumps, thermal and power transmission systems.			
Course Outcomes	After completion of the course, the students will be able to: 1. Demonstrate the working of different pumps and valves available onboard ships 2. Classify different Marine auxiliary systems 3. Explain the working principles of deck machinery and hull equipment 4. Explain the power transmission system deployed in ships 5. Demonstrate the safety systems deployed onboard ships 6. Identify the power systems and associated auxiliary systems (e.g. propulsion, refrigeration, and air conditioning) in support of the maritime sector.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	-	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	-	2	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	-	2	-	-	2	-	-	-	-	-	-	-	2	2
CO5	3	2	2	3	-	2	-	-	-	-	-	-	-	2	2
CO6	3	2	2	3	-	2	-	-	-	-	-	-	-	2	2
Avg.	3	2	2	3	-	2	-	-	-	-	-	-	-	2	2

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

UNIT I - MARINE PUMPS, PIPES AND VALVES **9 hrs**

Marine and special duty pumps, Details of pumps for marine purpose viz. condenser circulating pumps. Condensate and drain pumps, boiler feed pumps, bilge and ballast pumps rotary pumps. Marine piping – various types of piping system fitted-in ships, Expansion arrangements for pipes. Materials and corrosion in pipes

UNIT II - MARINE AUXILIARY SYSTEMS **9 hrs**

Waste heat recovery systems, hot water, drinking water, cooling water and sea water systems. Fuel systems, lubricating oil system-filters, coolers; centrifuges and clarities: Bilge and Ballast systems - sewage disposal, Oily water separator, incinerator

UNIT III - DECK MACHINERY AND HULL EQUIPMENT **9 hrs**

Deck machine and hull equipment - mooring, anchor handling, cargo handling -dry Cargo handling equipment - winches, cranes, Cargo gear, patent hatch covers, ventilation and cleaning of tankers, emergency equipment, watertight doors, stabilizers, chain blocks; tackles; Anchors, anchor cables.

UNIT IV - POWER TRANSMISSION SYSTEM **9 hrs**

Steering gears in marine use - different types -description construction, operation and maintenance. Shafting arrangements, stern tubes and, glands, - oil, Lubricated stern tubes, - shaft seals shaft alignment, Thrust block - reduction gearing. Propulsion - types for marine propulsion, constructional details, fixing, maintenance and operation, Ship, stabilizers;

UNIT V - SAFETY SYSTEMS **9 hrs**

Safety systems- firefighting equipment Instrumentation & Control, watch keeping system, Ship security reporting system, Automatic Identification System, Global Maritime Distress Safety System, Automated Manifest System (AMS), Vessel Monitoring System

Total: 45 Hours

TEXTBOOKS:

1. Harrington L.(1992), Marine Engineering, Society of Naval Architects and Marine Engineers.
2. Malcolm Latarche (2020), Pounder's Marine Diesel Engines and Gas Turbines-10th edition, Butterworth-Heinemann.
3. Mc George. H.D(1991), General Engineering Knowledge-3ed edition, Routledge Publications.
4. Mc George. H.D(1998), Marine Auxiliary Machinery-7th edition, Butterworth-Heinemann.

REFERENCES:

1. Anthony F.Molland (2008), The Maritime Engineering Reference Book, Butterworth-Heinemann.
2. Taylor, D.A.(1996), Introduction to Marine Engineering-2ed edition, Butterworth-Heinemann.
3. Adam W.,Tomasz N (2020), Marine Navigation and Safety of Sea Transportation, CRC Press.

OFFSHORE ENGINEERING

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code **232NA1A55TD**	**Course Name** **OCEAN DATA ANALYSIS**	L	T	P	C
		3	0	0	3
Year and Semester		**Contact hours per week** (3Hrs)			

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Prerequisite course	NIL			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
				✓
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
Course Objectives	To understand basics principles of collection and analysis of wave and tidal data, wave climate statistics and their field application.			
Course Outcomes	After completion of the course, the students will be able to: 1. Explain basics of wave mechanics in ocean data analysis. 2. Evaluate the statistical description of wave records. 3. Discuss concepts of ocean surface wind. 4. Analyse wave forecasting methods. 5. Analyse wave climate statistics. 6. Elaborate the field ocean data on tide, wind and wave for design purposes.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	2	-	3	-	-	-	-	2	2	3	3
CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	3	3
CO3	2	2	3	-	2	-	3	-	-	-	-	2	2	3	3
CO4	2	2	3	-	2	-	3	-	-	-	-	3	2	3	3
CO5	2	2	3	-	-	-	2	-	-	-	-	-	2	3	3
CO6	2	2	2	-	2	-	3	-	-	-	-	3	2	3	3
Avg.	2.0	2.0	2.5	-	2.0		2.8	-	-	-	-	2.5	2.0	3.0	3.0

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

UNIT I - BASICS OF WAVE MECHANICS **9 Hrs**

Wave properties- dispersion relationships-wave length calculations- wave energy-wave breaking-linear wave theory-wave superposition- basics of random waves– group velocity-phase velocity

UNIT II - STATISTICAL DESCRIPTION OF WAVE RECORDS **9Hrs**

Significant wave height-significant wave period-average wave period and wave height-time series of wave data-analysis and numerical examples.

UNIT III - OCEAN SURFACE WIND **9Hrs**

Wind generation-Sources – Observations-Rose By Number- Wind data analysis-Wave Spectrum- Classifications

UNIT IV - WAVE FORECASTING **9 Hrs**

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Manual methods-Empirical working procedures- Computation of wind waves-Determining sea state characteristics for given wind speed and fetch-for increasing wind speed-computation of swell-shoalingand refraction of swell in a coastal zone

UNIT V - WAVE CLIMATE STATISTICS **9 Hrs**

Sea-state parameters-return value of wave height-estimation-wave data presentation-histograms-wave Hind casts- hind cast procedure-probability distribution of wave heights. **Long term wave analysis–** Gumbel Distribution – Weibull Distribution – Introduction to SWAN and WAVEWATCH models.

TOTAL :45 Hours

TEXTBOOKS

1. Guide to wave analysis and Forecasting – Published by World Meteorological Organization WMO-No.702, 1998.

REFERENCES

1. J.S. MANI, "Coastal Hydrodynamics" PHI Learing Private Limited

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C	
232NA1A45TE	**RENEWABLE ENERGY SOURCES**	3	0	0	3	
Year and Semester		**Contact hours per week** (3Hrs)				
Prerequisite course	NIL					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**		
				✓		
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**		
Course Objectives	To understand tidal energy generation processes used in renewable energy resources and concept of nuclear power systems.					
Course Outcomes	After completion of the course, the students will be able to: 1. Explain renewable and non-renewable sources of energy. 2. Discuss existing Wind Energy Conversion System.					

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	3. Apply the application of Ocean energy and energy conversion system. 4. Design solar thermal and solar photovoltaic power generating units in various modes. 5. Design the fuel cells and various electric energy conversion systems. 6. Elaborate applications of different renewable energy sources like ocean thermal, hydro, geothermal energy etc.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	3	-	-	-	-	2	2	2	2
CO2	3	2	2	-	2	`-	2	-	-	-	-	2	2	3	2
CO3	3	3	2	2	2	-	2	-	-	-	-	2	2	2	2
CO4	3	2	2	2	2	-	3	-	-	-	-	2	3	2	2
CO5	3	2	2	2	2	-	3	-	-	-	-	3	2	2	2
CO6	3	2	3	2	2	-	3	-	-	-	-	3	2	2	2
Avg.	3.0	2.2	2.2	2.0	2.0	-	-	-	-	-	-	2.3	2.2	2.2	2.0

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

UNIT I – ENERGY SOURCES 9Hrs

Energy Sources: Definition, Units, Forms of Energy, Power, Origin of Fossil fuels, World and Indian Resources of Coal, Oil, Natural gas, Nuclear, Geothermal, Renewable Energy potential : Solar Energy, Wind Energy, Bio-Energy, Hydro, Tidal, Ocean , Fuel Cells ,Waste to Energy Conversion, Hydrogen energy-International Energy Agency-IREDA

UNIT II – WIND ENERGY CONVERSION 9Hrs

Wind Energy Conversion - Wind energy conversion principles; General introduction; Types and classification of WECS; Power, torque and speed characteristics. – Site Selection Criteria – Advantages – Limitations – Wind Rose Diagram – Indian Wind Energy Data – Organizations like C-WET etc., Wind Energy Conversion System - Design - Aerodynamic design principles; Aerodynamic theories; Axial momentum, blade element and combine theory; Rotor characteristics; Maximum power coefficient; Prandlt's tip loss correction.

UNIT III – ENERGY FROM OCEANS 9Hrs

Wave energy-various wave energy devices-Indian wave energy program-wave power extraction methods and devices-prototypes.

Tidal energy –principles and operations- operating mode - overfilling of the basins - Energy content-Tidal power plants in India.

Ocean Thermal Energy Cycle (OTEC) – Working principles-functions and operations

Geothermal Energy-Principles

UNIT IV – SOLAR ENERGY 9Hrs

Solar constant, Solar Radiation spectrum, Classification of Solar cells ñ First generation ñ Single crystalline, Poly crystalline, Second Generation ñ Thin film, CdS, CIGs, Third

Generation ñ Polymer based, DSSC, Parovskites, Hybrid, Quantum Dots, Multi Junction Tandem cells. (And/Or) Organic, Inorganic and Hybrid cells. Key elements of Silicon Solar cell, PV Solar cell, Module, panel and array. Solar thermal systems types, applications of Solar PV and Solar Thermal systems.

UNIT V - FUEL CELLS **9Hrs**

Fuel cells - General systems - Reactions - Gibbs' rule - of formation - Internal cell voltage - Types of fuel - Design of fuel cell systems - applications - Conversion – problems

Principles of hydrogen energy- Green Hydrogen-Hydrogen fuel cells

Total:45 Hours

TEXTBOOKS

1. Garg, Prakash, Solar Energy, Fundamentals and Applications, Tata McGraw Hill.
2. Dan Charis, Mick Sagrillo, LanWoofenden, ìPower from the Windî, New Society Pub.,2009.
3. Solar Cells: From Materials to Device Technology edited by S. K. Sharma, Khuram Ali, Springer (2020).
4. Rational Design of Solar Cells for Efficient Solar Energy Conversion edited by Alagarsamy Pandikumar, Ramasamy Ramaraj, Wiley (2018).
5. Environmental Justice in India: The National Green Tribunal, By Gitanjali Nain Gill, Routledge (2016).

REFERENCES

1. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 1996.
2. Paul Gipe, “Wind Energy Comes of Age”, John Wiley & Sons Inc., 2000.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**						
Course Code	**Course Name**			L	T	P	C
232NA1A75TF	**DYNAMICS OF OFFSHORE STRUCTURES**			3	0	0	3
Year and Semester		**Contact hours per week** (3Hrs)					
Prerequisite course	Elements of Offshore Engineering						
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**			
				✓			

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	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	To understand and evaluate the dynamic characteristics and response of both floating and fixed offshore structures in single and multi-degree of freedom
Course Outcomes	After completion of the course, the students will be able to: 1. Analyze the dynamics of ocean structures. 2. Explain basic concepts involved in free and forced vibration of single degree of freedom systems in structural dynamics by solving motion equations. 3. Analyze the equations of motion for MDOF system, estimate natural frequencies and mode shapes. 4. Evaluate response of offshore structures, by mathematical analysis. 5. Perform dynamic analysis of fixed and floating offshore structures. 6. Analyze the dynamics of offshore structures for various motion parameters.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	3	-	-	-	-	2	3	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	3	2	3
CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3
CO6	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3
Avg.	3.0	2.8	2.8	2.0	-	-	3.0	-	-	-	-	2.0	3.0	2.3	2.5

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

UNIT I – FUNDAMENTALS OF DYNAMICS 9Hrs

Introduction to different types of ocean structures - Environmental forces -Structural action of ocean structures, Basic features of dynamic loading and response – models for dynamic analysis – lumped mass, generalized displacements, Degrees of freedom – Translational and rotational systems

UNIT II – SINGLE DEGREE OF FREEDOM SYSTEM 9Hrs

Free vibration - Equation of motion, Damped free vibration, critically damped, under damped and over damped systems, Negative damping. Forced vibration - Response to harmonic loading, magnification factor, Undamped and damped system, Comparison in response build up. Response to periodic loading -Fourier series expansion - response to Fourier series loading, Exponential form of Fourier series loading and response- Formulation of equation of motion to numerical problems.

UNIT III – MULTI-DEGREE OF FREEDOM SYSTEM 9Hrs

Equations of motion and response of free and forced (harmonic) vibration - Natural frequencies and mode shapes, Eigenvalues and eigenvectors - Orthogonality of modes,

Stodola, Rayleigh-Ritz and influence coefficient methods, Problems - Duhamel's integrals**.**

UNIT IV – STRUCTURAL RESPONSE OF OFFSHORE STRUCTURES 9Hrs

Dynamic analysis of fixed and floating offshore structures, Dunkerley - Matrix methods for dynamic analysis -Modal response method - Modal mass contribution Numerical integration technique - Newmark-Beeta, Runge-Kutta methods.

UNIT V – DYNAMIC ANALYSIS 9Hrs

Mathematical modelling, Analysis and Structural response of Jacket platform, Offshore Triceratops, Tension Leg Platform.

Total: 45 Hours

TEXTBOOKS

1. Anil K. Chopra. 2003. Dynamics of structures: Theory and applications to earthquake Engineering: Pearson Education, Singapore.
2. ArvidNaess and TorgeirMOan. 2013. Stochastic dynamics of marine structures, Cambridge University Press, New York, USA.
3. James F. Willson, Dynamic of offshore structure, John Wiley & Sons Inc.

REFERENCES

1. Clough,R.W. and Penzien, J., Dynamics of structures, McGraw Hill, 1993.
2. Meirovitch L., Elements of Vibration Analysis, Mc.Graw Hill, 1986.
3. IS 1893 – Criteria for Earthquake Resistant Design of Structures, 2002.
4. SP 22: Explanatory Handbook on Codes for Earthquake Engineering.
5. Meirovitch L., Elements of Vibration Analysis, Mc.Graw Hill, 1986.
6. Thomson W.T., Theory of Vibration with Applications, Pearson Education Inc., 1998.
7. Craig, Jr. R.R., Structural Dynamics, John Wiley, 1981.
8. Hurty, W.C. and Rubinstein M.F., Dynamics of Structures, Prentice Hall, 1964.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
232NA1A55TG	**SUBSEA PIPELINE AND RISERS**	3	0	0	3

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Year and Semester		**Contact hours per week** (3Hrs)		
Prerequisite course	Elements of offshore Engineering			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
				✓
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
Course Objectives	To understand components like risers, pipeline design & analysis and different methods of installations & commissioning of subsea pipeline and pipeline guideline.			
Course Outcomes	After completion of the course, the students will be able to: 1. Explain the offshore pipeline and their components. 2. Analyze the hydrodynamics of offshore pipelines. 3. Analyze the offshore pipeline installation and commissioning various conditions. 4. Examine the design criteria and considerations for riser systems. 5. Implement the ASB guidelines for the design, installation, commissioning of subsea pipeline and rise. 6. Explain the design, installation, commissioning subsea pipeline principles for the design of subsea pipeline and rise for various field conditions.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	3		3	-	-	-	-	2	2	2	2
CO2	3	3	3	3	3		3	-	-	-	-	2	2	3	3
CO3	3	3	3	3	3		3	2	-	-	-	2	2	2	2
CO4	3	3	3	3	3		3	-	-	-	-	2	3	2	2
CO5	3	3	3	-	2		3	2	-	-	-	-	2	3	2
CO6	3	3	3	3	3		3	-	-	-	-	2	3	3	3
Avg.	3.0	3.0	3.0	3.0	2.8		3.0	2.0				2.0	2.3	2.5	2.3

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

UNIT –I INTRODUCTION TO SUBSEA PIPELINES AND RISERS **9Hrs**

Overview of subsea oil and gas transportation-Importance of pipelines and risers in offshore operations-Historical developments and case studies

UNIT II – HYDRODYNAMICS AND DESIGN PRINCIPLES OF OFFSHORE PIPELINE **9Hrs**

Fluid behavior in subsea pipelines-Hydraulics and pressure drop calculations-Flow assurance challenges and solutions. Design considerations and factors- Pipe sizing, wall thickness, and pressure containment- Pipeline codes and standards.

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UNIT III – PIPELINE INSTALLATION AND COMMISSIONING **9Hrs**

Pipeline survey and mapping, Pipeline route engineering; Pipeline Installation Methods.- S-lay, J-lay, Reel lay and trenching burial methods - pre-commissioning, and commissioning, Pipeline integrity aspects including in-line inspection,. Flow assurance; Pigging Operations

UNIT IV – RISERS AND DESIGN COSIDERATIONS **9Hrs**

Riser – different types of risers- **flexible, steel catenary, lazy wave, etc.**; Riser components, Riser Bends, Riser Clamps; Different riser configurations; riser failure modes; structural riser analysis; static and dynamic riser analyses; riser design criteria and considerations.

UNIT V– SUBSEA PIPELINE SYSTEM AND ABS CLASSIFICATION **9Hrs**

Subsea pipeline system- ABS classification- plans and specifications - design data-Safety Devices. Survey, Scope-General requirements-Selection of Materials-Pipe Components and Pipe Coating-Corrosion Protection Coating-Corrosion Control Types- Control-allowance.

Total: 45 Hours

TEXTBOOKS

1. Offshore Pipelines - By Dr. BoyunGuo -University of Louisiana at Lafayette, Shanhong Song ChevronTexaco Overseas Petroleum Company ,Jacob Chacko, INTEC Engineering, Inc. ,Dr. Ali Ghalambor University of Louisiana at Lafayette.
2. Shashi Menon, Piping Calculations Manual (McGraw-Hill Calculations)– December 10, 2004.
3. Subsea Pipeline Engineering (2004). A.C. Palmer and R.A.King, ISBN 159370013X.
4. Offshore Pipeline Design, Analysis, and Methods (1981). A.H. Mousselli, Pennwell Crop, ISBN 0878141561.
5. Offshore Pipelines (2005). B. Guo, S.Song, A. Ghalambor and J.Chacko, Elsevier Science, ISBN 075067847X.

REFERENCES

1. Subsea and Pipeline Engineering (1993). Various, Bentham Press, ISBN 1874612129
2. ABS Guidelines for pipeline systems.
3. Peter Smith ,The Fundamentals of Piping Design (Process Piping Design) (v.1) Hardcover – April 15, 2007.
4. M. W. Kellogg, "Design of Piping Systems Paperback – July 6, 2011.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
232NA1A65TH	**COASTAL DISASTER MANAGEMENT**	3	0	0	3
Year and Semester		**Contact hours per week** (3Hrs)			

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Prerequisite course	NIL			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
				✓
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
Course Objectives	To understand coastal disasters and its mitigation measures to execute safely and productively.			
Course Outcomes	After completion of the course, the students will be able to: 1. Explain various types of coastal disasters 2. Evaluate the physical process of tsunami waves and its effects 3. Evaluate the physical process of storm surges and its effects 4. Analyze the process of marine pollution, tidal effects and its mitigation measures. 5. Discuss the historical perspectives on coastal disasters, especially in Indian Context and NDMA missions. 6. Analyze various types of coastal disasters and its mitigation measures.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	3	-	-	-	-	3	2	2	2
CO2	2	-	-	-	2	-	3	-	-	-	-	3	2	2	3
CO3	2	-	-	-	2	-	3	-	-	-	-	3	2	2	3
CO4	2	-	-	-	2	-	3	-	-	-	-	3	2	2	2
CO5	2	-	-	-	2	-	3	-	-	-	-	2	2	2	3
CO6	2	-	-	-	-	-	3	-	-	-	-	2	2	2	3
Avg.	2.0	-	-	-	2.0	-	-	-	-	-	-	2.7	2.0	2.0	2.7

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

UNIT I - COASTAL DISASTERS **9Hrs**

Introduction – definitions- types of various coastal disasters like Tsunamis, Storm Surges and tidal bores- Coastal floods- coastal upwelling- coastal erosion-

UNIT II - TSUNAMIS **9Hrs**

Origins - generation- historical records of tsunamis. Hydrodynamics of tsunamis and Tsunami Early Warning Systems, Construction of tsunami walls, levees etc.- Mitigation of their effects.

UNIT III - STORM SURGES **9Hrs**

Storm surge: basic metrological disturbance, reasons occurrence of cyclone, movements of cyclones in northern and southern hemisphere –Cyclonic track - wind speed -intensity of cyclone – raise in water level. Impacts of storm surge in low laying areas and river mouths –

inundation associated with rain - Rain dominated event - Surge dominated event. Mitigation and their effects.

UNIT IV - MARINE POLLUTION **9Hrs**

Definition- sources- marine debris, heavy metal pollution, oil and thermal pollution, - marine pollution monitoring and abatement programs

UNIT V - HISTORICAL PERSPECTIVE COASTAL DISASTERS **9Hrs**

Disaster management in India-NDMA-vulnerability assessment in coastal disaster management, island risk management pertaining coastal disasters. Community based disaster management system.

Total: 45 Hours

TEXTBOOKS

1. Sharma, R.K. & Sharma G, Natural disaster. APH publishing corporations, 2005, New Delhi
2. Handbook of Coastal Disaster Mitigation for Engineers and Planners, Edited by: Miguel Esteban, Hiroshi Takagi and TomoyaShibayama, Elsevier Publications.

REFERENCES

1. Handbook of Coastal Disaster Mitigation for Engineers and Planners, Edited by: Miguel Esteban, Hiroshi Takagi and Tomoya Shibayama, Elsevier Publications.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C
232NA1A55TI	**WAVE MECHANICS**	3	0	0	3
Year and Semester		**Contact hours per week** (3Hrs)			
Prerequisite course	Marine Hydrodynamics				

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

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Course Objectives	To understand mechanics of water waves in ocean and the methods to describe the ocean characteristics.
Course Outcomes	After completion of the course, the students will be able to 6. Apply the basic knowledge of fluid mechanics to water waves. 7. Demonstrate the concepts of wave kinematics and wave dynamics using linear wave theory. 8. Explain various wave theories. 9. Illustrate the types of wave deformation and currents. 10. Estimate wave forces using Morison equation. 11. Apply spectral analysis to irregular and random waves that describe various sea states

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	2	-	3	-	-	-	-	2	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
CO6	3	3	3	3	2	-	3	-	-	-	-	2	3	3	3
Avg.	3.0	3.0	2.8	3.0	2.3		3.0					2.0	3.0	3.0	3.0

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

UNIT I – WATER WAVES 9 Hrs

Fluid mechanics basics, Bernouli's equation- Waves- 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, Introduction to Wave theories

UNIT II – SMALL AMPLITUDE WAVES 9 Hrs

Velocity potential, 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

Nonlinear waves –Wave steepness, Nonlinear 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-Irribaren Number. Standing waves-Underwater Currents, Classification and its effects-rip currents

UNIT V – IRREGULAR WAVES AND FORCES 9 Hrs

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Irregular waves- Introduction, ocean wave analysis methods , spectral method ,statistical methods and parameters ,sea state, Wave forces: – small bodies and large bodies-Morison equation – Wave loads on vertical circular cylinders, Diffraction theory Principles- Wave slamming

Total: 45 Hours

TEXTBOOKS

1. R.K Bansal, A textbook of Fluid Mechanics, Laxmi Publications, 2008.
2. S.K Som, Gautham Biswas, S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Mc Graw Hill, 2011.
3. G.S. Sawhney, Fundamentals of Fluid Mechanics, I K International Publishing, 2011.

REFERENCES

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

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C
232NA1A65TJ	**DREDGING TECHNOLOGY**	3	0	0	3
Year and Semester		**Contact hours per week** (3Hrs)			
Prerequisite course	NIL				

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

Course Objectives	To understand dredging methods and able to perform design of dredgers and pumps
Course Outcomes	After completion of the course, the students will be able to: 1. Develop a dredging project and analyse the situations to solve field problems. 2. Explain dredging principles and reclamation in coastal areas. 3. Design Centrifugal dredge pumps. 4. Explain various aspects of cutter section dredgers.

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	5. Explain various aspects of Trailing suction hopper Dredgers. 6. Demonstrate the overall knowledge to undertake any Dredging Projects.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	2	2	-	3	-	-	-	-	2	2	3	2
CO2	3	2	2	-	2	-	3	-	-	-	-	2	3	3	3
CO3	3	3	3	3	3	-	3	-	-	-	-	2	2	3	2
CO4	3	2	2	3	3	-	3	-	-	-	-	2	3	3	2
CO5	3	2	2	3	3	-	3	-	-	-	-	2	3	3	2
CO6	3	3	3	3	3	-	3	-	-	-	-	2	3	3	3
Avg.	2.8	2.4	2.4	2.8	2.7	-	3.0	-	-	-	-	2.0	2.7	3.0	2.3

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

UNIT I - INTRODUCTION TO DREDGING 9 Hrs

Introduction to Dredging, definition of Dredging, Applications in various project, definition of Dredger, uses of dredgers for different types of dredging works, its relevance and impact in shipping operations in ports design of a dredging project-Dredging Corporation of India(DCI)

UNIT II - DISPOSAL OF SPOIL & ENVIRONMENTAL CONSIDERATIONS 9 Hrs

Disposal of spoil & Environmental considerations - Preliminary surveys - Subsurface investigations, disposal methods, hoppers, dewatering, reclamation-siltation case studies-environmental impacts, primary and secondary effects

UNIT III - FLUID MECHANICS OF DREDGING 9 Hrs

Fluid Mechanics of Dredging - Types of pumps and their Construction, theory of pumps, booster stations-density of dredged fluids, dredge types, hopper suction dredger layout, grab dredger types, cutter suction dredger and beavers, trailing suction dredgers, rock blasting methods

UNIT IV- CUTTER SUCTION DREDGERS 9 Hrs

Aspects of cutter suction dredging-overall features-selection of cutters-cutter device-anchoring system-spud system-cutter design principles

UNIT V - TRAILING SUCTION HOPPER DREDGERS 9 Hrs

Drag heads-hopper loading system-over flowing system-discharge system-measurement of density and velocity of dredged mixture-dredging cycle-agitation dredging - measure and read volume in hoppers

Total:45 Hours

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

TEXTBOOKS

1. The Loading process of a trailing suction hopper Dredger by Dr.IR.Sape A Miedema.
2. Dredging Technology by Van Der Schrieck G.L.M.
3. Dredging: A Handbook for Engineers. Bray R.N., bates A.D., and Land.J.M.Second edition, new York: John Wiley & Son Inc.

REFERENCES

1. Environmental Aspects of Dredging. Bray R.N., Editor, new York: Taylor & Francis Goup.
2. Proceedings: WEDA XXX1 Technical Conference and TAMU 42 Dredging Seminar.
3. Improvements for Dredging and Dredged Material Handling. R.Randall, A Drake., W.Cen.

<table>
<tr><td>PROGRAM</td><td colspan="6">B.E.-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
232NA1A75TK</td><td colspan="3">Course Name
ADVANCED OFFSHORE ENGINEERING</td><td>L
3</td><td>T
0</td><td>P
0</td><td>C
3</td></tr>
<tr><td>Year and Semester</td><td colspan="3"></td><td colspan="4" rowspan="2">Contact hours per week
(3Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="3">NIL</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="4">Professional Elective</td></tr>
<tr><td></td><td></td><td></td><td colspan="4">✓</td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="4">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="4"></td></tr>
<tr><td>Course Objectives</td><td colspan="7">To understand types of dredging methods and able to perform design of dredgers and pumps.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">After completion of the course, the students will be able to:
1. Develop a dredging project and analyse the situations to solve field problems.
2. Explain dredging principles and reclamation in coastal areas.
3. Design centrifugal dredge pumps.
4. Discuss various aspects of cutter section dredgers.
5. Discuss the various aspects of trailing suction hopper dredgers.
6. Demonstrate the overall knowledge to undertake dredging projects.</td></tr>
</table>

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

UNIT I: ADVANCED ANALYSIS FOR OFFSHORE STRUCTURES 9Hrs

Introduction to Fatigue and fracture mechanics- Nonlinear structural analysis techniques-

Advanced load modeling and analysis- Reliability and risk assessment

UNIT II - COMPUTATIONAL METHODS IN OFFSHORE ENGINEERING 9 Hrs

Overview of Finite element analysis (FEA) for offshore structures-Computational fluid dynamics (CFD) for wave and wind loads- Multi-body dynamics simulation

UNIT III - SUBSEA SYSTEMS AND PIPELINE DESIGN 9 Hrs

Subsea architecture and components - Flow assurance and pipeline integrity- Deepwater pipeline design considerations

UNIT IV - OFFSHORE RENEWABLE ENERGY SYSTEMS 9 Hrs

Offshore wind energy: design and installation- Tidal and wave energy systems- Environmental impact assessment for renewable installations

UNIT V - OFFSHORE GEOTECHNICAL ENGINEERING 9 Hrs

Seabed characterization and geotechnical site investigation, Penetrometer, piezocone, vane and pressure meter techniques- Soil-structure interaction in the marine environment, Reese-Matlock method & p-y curves method.-Offshore foundation design- Stability under static and cyclic load effects

Total:45 Hours

TEXTBOOKS

1. The Loading process of a trailing suction hopper Dredger by Dr.IR.Sape A Miedema.

2. Dredging Technology by Van Der Schrieck G.L.M

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

3. Dredging: A Handbook for Engineers. Bray R.N., bates A.D., and Land.J.M.Second edition, new York: John Wiley & Son Inc.

REFERENCES

1. Environmental Aspects of Dredging. Bray R.N., Editor, new York: Taylor & Francis Goup.
2. Proceedings: WEDA XXX1 Technical Conference and TAMU 42 Dredging Seminar.
3. Improvements for Dredging and Dredged Material Handling. R.Randall, A Drake., W.Cen.

SHIP DESIGN

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code **232NA1A55TL**	**Course Name** **LIFTING SURFACES FOR MARINE APPLICATIONS**			L	T	P	C
				3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)					
Prerequisite course	Marine Hydrodynamics						
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**			
				✓			
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**			
Course Objectives	This course provides the basic Hydrodynamic concept for lifting surface and its application, also the design requirement of Propeller, rudder and its interaction.						
Course Outcomes	After completion of the course, the students will be able to 1. Recognize the importance of fluid mechanics in lifting surface design 2. Implement the concepts of hydrodynamics in developing the control surfaces 3. Design the propeller for the given vessel 4. Classify different types of rudders and their applications 5. Design the rudder for the given vessel 6. Improve the understand of concepts involved in the design procedure for fins and hydroplanes						

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POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	-	-	-	-	2	2	-	-	-	-	-	-	3	2
CO3	3	3	3	-	2	-	2	-	2	-	-	-	-	3	2
CO4	2	2	3	-	2	-	2	-	2	-	-	2	3	2	2
CO5	3	3	3	-	2	-	2	-	2	-	-	-	-	2	2
CO6	2	-	2	-	-	2	2	-	2	-	-	2	3	2	2
Avg.	2.60	2..75	2.75	-	2	2	2	-	2	-	-	2	3	2.50	2
CORRELATION LEVELS		1. SLIGHT (LOW)			2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)						

UNIT I – HYDRODYNAMIC CONCEPTS **9 hrs**

Recapitulation of concepts in Marine Hydrodynamics – Uniform flow, Streamlines, pressure velocity changes in a moving fluid, stagnation point, vortex flow, Reynold's number, boundary layer, flow separation

UNIT II – LIFTING SURFACES FOR MARINE APPLICATIONS **9 hrs**

Lifting foils and its properties, Geometry of a lifting foil; Induced drag – Aerofoils of infinite and finite span– fixed and movable, Lift and drag, Lifting line theory

UNIT III – PROPELLER **9 hrs**

Propeller geometry, actuator disk, propeller lifting line theory, potential flow around a circle, Kutta condition, vortex lines, vortex lattice method, cavitations, propeller design procedure, Case Study – Design of propeller for the given vessel

UNIT IV – RUDDER **9 hrs**

Rudder types, rudder action, single screw and twin screw arrangements, rudder-propeller interaction, influence of hull on rudder-propeller performance, rudder design strategy, hydrodynamics characteristics, Free surface effects – rudder submerged condition, surface piercing condition, cavitation, high-lift rudders-Skeg Case Study – Design of rudder for the given vessel

UNIT V – OTHER LIFTING SURFACES **9 hrs**

Fin stabilizers – applications, design procedure, section design, cavitation, operation, roll stabilization; Hydroplanes – applications, design procedure and data, operation; Pitch damping fins – applications, design procedure and data, operations

Total: 45 Hours

TEXTBOOKS

1. Volker Bertram, Practical Ship Hydrodynamics, Butterworth Heinemann (Elsevier), 2000.
2. Edward V. Lewis, Principles of Naval Architecture (Vol. 3 - Motions in waves and controllability), 3rd edition , SNAME1988.

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

3. R.K Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications, 2008

REFERENCES

1. Abbott, I.H. and Doenhoff, A.E.V.Theory of wing sections, New York: Dover publications, 1958.
2. S.K Som, Gautham Biswas, S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Mc Graw Hill, 2011.
3. Perez, T.Ship Motion Control - Course keeping and roll stabilization using rudder and fins, Springer-Verlag London Limited, 2005

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code **232NA1A65TM**	**Course Name** **FISHING VESSEL TECHNOLOGY**			L	T	P	C
				3	0	0	3
Year and 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 obtain basic knowledge on fishing methods and equipment's 2. Understanding the design factors of fishing vessel and resistance components					
Course Outcomes	After completion of the course, the students will be able to 1. List types of fish and different methods of fishing 2. Classify the different types of fishing gear 3. Explain the preservation of fish on board the vessel 4. Calculate the resistance of a fishing vessel 5. Choose the materials used in fishing vessel construction 6. Develop the design of a fishing vessel					

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	2	-	2	2	2	2	2	2
CO2	2	2	2	3	2	2	3	2	-	2	2	2	2	2	2
CO3	3	3	3	2	3	2	2	2	2	2	2	2	2	3	2
CO4	3	3	3	2	3	2	2	2	2	2	2	2	3	2	2
CO5	2	3	2	2	2	2	3	2	2	2	2	3	3	3	2
CO6	2	2	3	3	3	3	3	2	3	2	2	3	3	3	2
Avg.	2.33	2.5	2.5	2.33	2.33	2.16	2.33	2	2.25	2	2	2.33	2.50	2.50	2

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

UNIT I - INTRODUCTION **9hrs**

Importance of fishing Industry; Marine and Inland water Fishing; Capture and Culture Fishing; Fishing methods – Purse seining, Drift netting, Gillnet fishing, Long line fishing, Pole and line fishing; Trawling, Harpooning

UNIT II - FISHING GEARS **9hrs**

Components of fishing gears: netting materials, floats, sinkers, rop. Types of Fishing Gears-Towed gear; Encircling Gear; Static Gear; Towing arrangements; Stern trawling operations and equipment, Long Liner Vessel; Fishing Nets; Selective fishing and Non Selective Fishing.

UNIT III – FISH HOLD DESIGN **9hrs**

Storing and preservation of fish on board a vessel; Fish hold arrangement, Hold Insulation Materials, Icing and Estimation of Ice Requirement; Refrigerated Seawater Cooling (RSW) ; Chilled Seawater Cooling (CSW); Refrigeration Machinery.

UNIT IV – VESSEL DESIGN **9hrs**

Introduction to international and national regulations governing fishing vessel design Determination of Principal Dimensions; Generation of Lines Plan; General arrangement, Deck Equipment; Estimation of components weights; Vessel stability and safety considerations during towing operations; Resistance & Propulsion calculations; Mother Vessel

UNIT V – MACHINERY &COST ESTIMATION **9hrs**

Main and auxiliary machinery; Electrical systems; Structural arrangements. Materials for construction; Economics of fishing vessels- NPV, IRR, Selectivity Study

Total: 45 Hours

TEXTBOOKS

7. Design of small fishing vessel, john F. Fyson, Food and agriculture organization of the united nations-1985
8. Fishing boats and their equipment, Dag Pike, 1992

REFERENCES

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

9. Fishing boat designs, 3small trawlers, issues 188-191, john f,fyson, Food and agriculture organization of the united nations-1985

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
232NA1A65TN	**INLAND WATER TRANSPORTATION**	3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)			
Prerequisite course	Engineering Mathematics				

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

Course Objectives	To apply the various steps involved in the operation and design of Inland waterway transportation from sea going vessels.
Course Outcomes	After completion of the course, the students will be able to 1. Identify the various features of inland water transportation methods 2. Develop the facilities required for the inland water transportation. 3. Design an inland water vehicle for Indian waters 4. Examine the various design requirements in inland waterways 5. Construct the structural arrangement of Inland water vessels using classification society rules. 6. Identify the propellers required for Inland water vessels

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	2	2	-	-
CO2	2	2	3	2	-	2	-	-	-	-	-	-	-	2	-
CO3	2	2	2	2	-	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	-	2	-	-	-	-	-	3	2	2	3
CO5	2	3	3	3	-	2	-	-	-	-	-	2	2	2	2
CO6	-	-	3	2	-	2	-	-	-	-	-	2	2	2	2
Avg.	2.20	2.50	2.80	2.20		2.20						2.25	2	2	2.25

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

UNIT I - INTRODUCTION TO INLAND WATER TRANSPORTATION **9hrs**

Inland waterways and their peculiarities; Maintenance of navigation channels; Siltation and its effects, Bank erosion-effects; Dredging and its effects on Inland waterways; Indian national waterways-Inland Waterways Authority of India (IWAI)-its functions and programs

UNIT II - TRANSPORTATION FACILITIES **9hrs**

Inland river ports; Jetties and infrastructural facilities for Intermodal transportation- water, rail and road; Specialized inter modal transportation vessels.

UNIT III – INLAND WATER VEHICLE DESIGN **9hrs**

Inland water vessels features; Design process; Low wash and low draft self-propelled vessels; dumb barges; flotilla, pusher tugs, passenger ferry, hospital ship.

UNIT IV - STRUCTURAL DESIGN OF INLAND WATER VEHICLES **9hrs**

Basic Principles - Materials used for Inland water vehicle construction, structural components and scantlings, Classification society rules, registration rules.

UNIT V – PROPULSORS FOR INLANDWATER VEHICLE **9hrs**

Selection of propulsion system, Propellers for inland water vessels; Special features-tunnels; Shrouded propellers, water-jet propulsion.

Total: 45 Hours

TEXTBOOKS

1. Dejan Radojcic, Aleksandar Simic, Nikola Momcilovic, Milorad Motok, Benjamin
2. Friedhoff, Design of Contemporary Inland Waterway Vessels, Springer, 2021.

REFERENCES

1. Bart Wiegmans, Rob Konings, Inland Waterway Transport: Challenges and prospects, 1st Edition, Routledge, 2017

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C
232NA1A75TO	**WARSHIP TECHNOLOGY**	3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)			
Prerequisite course	NIL				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
				✓	

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	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	This course provides the understanding of various aspects of Warships and submarines. Also familiarizing its types, capabilities, arrangements, weapon system and sensors.
Course Outcomes	After completion of the course, the students will be able to: 1. Relate the Warship and Submarine projects-design and constructions. 2. Explain various aspects related to the Warships and Submarines 3. Construct the General arrangement of warships 4. Examine the control systems and weapon on board of a warship 5. Estimate the value of development of warships 6. Plan to join in the Indian Navy or a PSU as a career option for the students

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	3	-	-	-	-	-	-	-	2	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO4	-	3	-	-	-	-	-	-	-	-	-	3	2	3	3
CO5	-	3	3	3	2	-	-	-	-	-	-	3	3	3	3
CO6	-	2	-	-	2	-	-	-	-	-	-	-	3	3	2
Avg.	3	2.60	3	3	2.50	-	-	-	-	-	-	3	2.60	3	2.75

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

UNIT I: INTRODUCTION TO WARSHIPS **9hrs**

Utility Concept of warships, Type of Warships, Classification of warships and their functions,

UNIT II: GENERAL ARRANGEMENT **9hrs**

Various decks and arrangements, Weapons positioning, magazines, Hull, Engineering, accommodation, Bridge navigation system etc.

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

Design spiral, rules for classification , Warship specifications and standards, Vibration, Shock, Subdivision, damage, Electronical Interactions, FW system, SW system, Weapon systems, Anchor chain cable system, towing and mooring arrangements, HVAC, Cold and Cool Room system, NBC warfare, Citadel, ATUs/AHUs, ER arrangements, Auxiliary machinery, Generators, Emergency generator, Masts, Lights, human fatigue. Stealth considerations for design

UNIT IV: FRIGATES - DESTROYERS & WEAPON SYSTEM **9hrs**

Role of Frigates & destroyer, Typical Frigate Profile, Weapon Systems-, Naval Communication Systems, Typical Weapon Systems-, Integration of Ship, Sensors and weapon systems- close in weapon system-Medium range guns –guns fitted in flatform, Overall ability and effectiveness of a warship, Weapons and fighting Capabilities- Function of missiles and range, Propulsion Machinery

UNIT V: SUBMARINE DESIGN AND CONTROL SYSTEMS **9hrs**

Buoyancy & Floatation of submarine Types of submarines, Utility Concept of submarines, GA of submarine, submarine sensors The basic design process, Characteristics and development of submersibles, Submersible vehicles support systems, Design and operating safety, Rules for classification of submarines, commercial submarines.

Total: 45 Hours

TEXTBOOKS

1. EE Allimendinger, Submersible vehicle systems design. SNAME, 1990.
2. Norman Friedman, Modern Warship: Design and Development, 1st edition, Mayflower Books, 1980.
3. Christopher Lavers, Reeds Vol 14: Stealth Warship Technology, 1st edition, Bloomsbury Publishing, 2012.

REFERENCES

1. R.M. Newton, Practical Construction of Warships, 2nd edition, Sterling Book House, 1970.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C
232NA1A75TP	**ADVANCED FLUID DYNAMICS**	3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)			
Prerequisite course	Fluid Mechanics				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
				✓	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
Course Objectives	1. Obtaining a basic knowledge on kinematics and conservation laws of fluid flow systems 2. Overview of the concepts of boundary layer and flow in transition. 3. Familiarizing with fundamentals of computational fluid flow.				
Course Outcomes	After completion of the course, the students will be able to: 1. Apply the fundamentals of kinematics and conservation laws of fluid flow systems. 2. Develop the principles of high and low Reynolds number flows to fluid flow systems. 3. Analyse the laminar and turbulent flow regimes. 4. Review the concepts of boundary layer and flow in transition. 5. Build the fundamentals of computational fluid dynamics. 6. Demonstrate on Fluid-structure interaction.				

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POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	3	2	2	2	-	2	3	-	2
CO2	3	2	2	2	-	2	3	2	2	2	2	2	3	2	2
CO3	3	2	2	2	2	2	3	-	2	2	2	2	3	2	2
CO4	3	2	2	2	-	2	3	2	2	2	2	2	3	2	2
CO5	3	2	2	2	-	2	-	2	2	2	2	2	3	2	2
CO6	3	-	2	2	-	2	3	2	2	2	2	2	3	2	2
Avg.	3	2	2	2	2	2	3	2	2	2	2	2	3	2	2

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

UNIT I – REVIEW OF BASIC CONCEPTS AND FLUID PROPERTIES 9hrs

Basic law of Fluid Motion, Internal stresses and external forces on fluid elements, Review of Concepts of Kinematics of fluid motion, vorticity, circulation, velocity potential and stream function,irrotational flow. General theory of Stress and Rate of Strain Fundamental Equations – Integral formFundamental Equations

UNIT II – GOVERNING EQUATIONS OF FLUID FLOW IN DIFFERENTIAL FORM 9hrs

Navier – Stokes Equation and exact solutions, Energy equation and solution of fluid flow with thermal effects

UNIT III – DYNAMICS OF IDEAL FLUID MOTION 9hrs

Applications, Integrations of Euler's Equation of Motion, Generalized form of Bernoulli Equation, Potential flows, Principle of Superposition. Laminar and Turbulent flow of fluids

UNIT IV – FUNDAMENTALS OF CFD 9hrs

Conservation equations, boundary conditions, basic simulation strategy, dimensionless numbers. Discrete approximation of fields, storage of fields, spatial resolution, meshing strategies, cell types.Various methods in CFD-FDM-FVM-FEM- Discretisation and implementation

UNIT V – FLUID-STRUCTURE INTERACTION 9hrs

Introduction to FSI, simple example: coupling of inviscid compressible flow to a mass-springsystem, glimpse on numerical methods.

Total: 45 Hours

TEXTBOOKS

1. J.N. Newman, Marine Hydrodynamics, 9th Edition, MIT Press, Cambridge, MA, 1999.
2. S.K Som, Gautham Biswas, S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Mc Graw Hill, 2011
3. R.K.Rajput, A text book of Fluid Mechanics, 7th edition, S.Chand and Company Limited, New Delhi , 2007.

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

4. K.L.Kumar, Engineering Fluid Mechanics, 1st edition Reprint, Eurasia Publishing House (P) Ltd, New Delhi, 2006.

REFERENCES

1. A.J. Hermans, Water waves and ship hydrodynamics, 2nd edition, Springer, 2011.
2. Applied Hydrodynamics, Vallentine, Newness - Butterworth,1967.
3. Bernard Le Mehaute, An Introduction to Hydrodynamics and water waves, Springer, 1976.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code **232NA1A75TQ**	**Course Name** **GUIDANCE AND CONTROL OF MARINE VEHICLES**			L	T	P	C
				3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)					
Prerequisite course	Ship motion and control						
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**			
				✓			
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**			
Course Objectives	To learn various aspects of both manual and autonomous mode of control of a marine vehicle including surface ships and underwater vehicles						
Course Outcomes	After completion of the course, the students will be able to: 1. Analyze the hydrodynamic parameters required to control a marine vehicle 2. Explain the fundamentals in controlling a marine vehicle 3. Examine the controllability of surface ships 4. Identify different types of ROVs and their operations 5. Interpret the process involved in control of marine vehicle in autonomous mode 6. Categorize various aspects of manual and autonomous control of vehicle design						

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	2	-	-	-	-	-	2	2	2	2	2
CO2	3	3	-	-	-	-	-	-	-	-	-	2	2	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	3	3
CO4	3	-	2	-	2	-	2	-	-	-	2	2	2	2	2
CO5	2	2	3	2	3	-	-	-	-	-	-	2	3	3	3
CO6	3	2	3	3	3	-	2	-	-	-	-	2	3	3	3
Avg.	2.83	2.40	2.50	2.33	2.50	-	2	-	-	-	2	2	2.33	2.50	2.50

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

UNIT I – MARINE VEHICLE DYNAMICS 9hrs

Kinematics of moving frames; coordinate transformation, Newtonian and Lagrangian Mechanics; Rigid Body Dynamics; Hydrodynamics Forces and Moments; Environmental Disturbances

UNIT II – CONTROL SYSTEM FUNDAMENTALS 9hrs

Introduction – plants, inputs and outputs, the need for modelling, basic components of a control system, open-loop and closed loop control systems, Block diagrams, Laplace transform, representation of linear systems – transfer function, state-space form, conversion of state space and transfer function representations, PID controllers - Proportional only, Proportional-Derivative only, Proportional-Integral-Derivative – Benefits and drawbacks

UNIT III - CONTROLLABILITY OF SURFACE SHIPS 9hrs

Controllability, surface vessel linear model, Types of stability, stability of the sway/yaw system, Analysis of course keeping, basic rudder action in sway/yaw model, various maneuvers, Introduction to nonlinear equations

UNIT IV – CONTROLLABILITY OF UNDERWATER VEHICLES 9hrs

ROV overview, operational goals, classification, Flow characteristics for standard operations, Types of ROV services, Design theory – Vehicle design, stability and control, Standards and specifications, propulsion systems

UNIT V – AUTOMATIC CONTROL SYSTEMS 9hrs

System architecture for a Unmanned ship, Control concepts for autonomous ships, Adaptive autopilots, Course keeping with automatic control, Automatic controls of unstable vessels, Unstable ship – limits and difficulties, Input data and time lag effects

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Case study**:** Numerical modelling of surface ship or underwater vehicle control

Total: 45 Hours

TEXTBOOKS

1. Rameshwar Bhattacharya, Dynamics of Marine Vehicles, John Wiley & Sons Ltd, 1972.
2. Edward V. Lewis, Principles of Naval Architecture (Vol. 3 - Motions in waves and controllability), 3rd edition, SNAME, 1988.
3. Ben C. Gerwick Jr., Construction of Marine and Offshore Structures, 3rd edition, CRC Press., 2007.

REFERENCES

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

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**							
Course Code	**Course Name**				L	T	P	C
232NA1A75TR	**COMPUTER AIDED STRUCTURAL DESIGN- FEA**				3	0	0	3
Year and Semester			**Contact hours per week** (3 Hrs)					
Prerequisite course	NIL							
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**				
				✓				
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**				
Course Objectives	To understand the fundamentals of the ship's structural analysis applying finite element method and other numerical methods to solve engineering problems.							
Course Outcomes	After completion of the course, the students will be able to: 1. Apply the basic mechanics concepts for structural analysis 2. Learn the concept of virtual work and energy-based methods. 3. Solve structural problems using the matrix method of analysis. 4. Apply the finite element method in structural problem. 5. Learn the application of finite element method related to ship structure. 6. Discuss the use of numerical techniques in computer aided structural design.							

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POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
CO2	-	2	-	-	2	2	2	2	-	2	2	3	2	-	-
CO3	2	3	3	3	2	2	2	2	-	2	2	2	3	3	2
CO4	-	3	-	-	-	2	2	2	-	2	2	2	2	2	2
CO5	-	3	3	3	2	2	2	2	-	2	2	3	3	3	2
CO6	-	2	-	-	2	2	2	-	-	2	2	3	3	3	2
Avg.	2	2.60	3	3	2	2	2	2	-	2	2	2.60	2.60	2.75	2

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

UNIT I - INTRODUCTION TO STRUCTURAL ANALYSIS **9hrs**

Basic concepts in Mechanics; Types of structure; Force displacement relationship; Analysis of Statically Determinate Structures; Statical and kinematic indeterminacy.

UNIT II - ENERGY BASED METHODS **9hrs**

Principles of virtual works; Castiglione's theorems; Galerkin method; Introduction to flexibility and stiffness matrix method; formation of equation.

UNIT III - MATRIX METHODS **9hrs**

Determination of member and joint displacements; Equivalent joint loads, Stiffness matrix; Deformation matrix; Member and overall stiffness matrices. Boundary conditions; Effect of temperature variations.

UNIT IV – FINITE ELEMENT METHOD **9hrs**

Introduction to finite element method; Shape functions, Steps in FEA; ISO-parametric Formulation; Beam element; plane stress; plate bending.

UNIT V - FEM APPLICATIONS TO SHIP STRUCTURES **9hrs**

Objectives and general approach in ship structural analysis, Application of FEM to ship structures; deck beams and deck girders; frames; double bottoms; bulkheads; deck and side shell.

Total: 45 Hours

TEXTBOOKS

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

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REFERENCES

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

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code	**Course Name**	L	T	P	C
232NA1A75TS	**ADVANCED SHIP DESIGN**	3	0	0	3
Year and 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	Understand the functional requirements of ship during design stages and the cost estimation process of a ship.
Course Outcomes	After completion of the course, the students will be able to: 1. Estimate the Equipment numeral 2. Select machinery and propulsion system. 3. Illustrate the piping system 4. Examine the electrical, navigation and communication equipment selection 5. Estimate the building cost 6. Select Ship outfitting Equipment and other systems

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	-	2	2	2	2	2	2	2	2	2
CO2	3	2	3	2	2	2	2	2	2	2	2	3	3	2	3
CO3	2	2	3	2	3	2	2	2	2	2	2	2	2	2	2
CO4	3	3	3	3	2	2	2	2	2	2	2	2	3	2	3
CO5	3	3	2	3	2	2	2	2	2	2	2	2	2	2	2
CO6	3	3	3	3	3	2	2	2	2	2	2	3	3	2	3
Avg.	2.66	2.50	2.80	2.50	2.50	2	2	2	2	2	2	2.33	2.50	2	2.50

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

UNIT I - SHIP OUTFITTING DESIGN **9hrs**

Estimation of Equipment Numeral; Anchoring Equipment; Mooring Equipment; Cargo handling Equipment; Lifesaving and Firefighting Equipment;

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UNIT II - MACHINERY SELECTION, INSTALLATION AND PROPULSION SYSTEM 9hrs

Selection of Main Machinery, IMO Tier-I, II, III engines; Selection of propeller, Selection of Rudder and Steering Gear, Selection of Auxiliary Machinery; Scrubbers and waste heat recovery systems.

UNIT III – PIPING SYSTEMS 9hrs

Design of piping systems, Ballast and bilge water piping system, fuel oil system, fresh water system, seawater system; Ballast water treatment plant.

UNIT IV –BASICS OF ELECTRICAL, NAVIGATION AND COMMUNICATION EQUIPMENT SELECTION 9hrs

Electrical powering calculations, Sea load, Harbor load, Selection of Generators, Emergency generators, Switch boards, Power distributions; Navigation and communication equipment, lighting requirements in accommodation and other important compartments.

UNIT V – COST ESTIMATION 9hrs

Ship design and Ship building cost - cost of material, machinery and propulsive installation, accommodation/equipment/outfitting, labor and overheads, Tender Document Preparation.

Total: 45 Hours

TEXTBOOKS

1. Apostolos Papanikolaou, Ship Design: Methodologies of Preliminary Design, Springer, 2014.
2. D.G.M Watson, Practical Ship Design, 1st, Elsevier Science Ltd., 1998.
3. H.Schneekluth and V.Bertram, Ship Design for Efficiency and Economy, 2nd, Butterworth-Heinemann (Elsevier), 1998.
4. Robert Taggart, Ship Design & Construction, SNAME, 1980.

REFERENCES

1. E. C. Tupper, Introduction to Naval Architecture, 5th edition, Butterworth-Heinemann, (Elsevier), 2013.
2. Edward V. Lewis, Principles of Naval Architecture (Volume 1 - Stability and Strength), 3rd edition, SNAME, 1988.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C
232NA1A65TT	**SHIP VIBRATION AND NOISE**	3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)			
Prerequisite course	Strength of Ships				

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

Course Objectives	1. Obtaining a basic knowledge on ship structures 2. Familiarizing the fundamentals of the ship vibration and use knowledge for proper selection of structures 3. Practice to design of instrument and machinery mounts for reducing effects of harmful dynamic effects
Course Outcomes	After completion of the course, the students will be able to: 1. List the various structural elements of ships 2. Define dynamic system 3. Explain the importance mathematical aspects of single degree freedom free and force vibration systems 4. Design & develop the structures by avoiding the dynamic effects 5. Show the mathematical aspects of continuous system free and force vibration systems introduction to ship vibration 6. Extend ship vibration system for selecting engine and propeller details

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	3	-	-	-	3	-	2	2	2	2
CO2	2	3	3	2	-	2	2	-	-	2	2	2	2	2	2
CO3	2	2	2	3	2	3	2	-	2	2	2	2	3	3	3
CO4	2	3	3	2	3	3	2	2	2	2	2	3	2	2	2
CO5	2	3	3	3	3	2	3	3	2	2	3	3	3	2	3
CO6	3	3	3	3	2	2	3	3	2	2	2	3	3	2	3
Avg.	2.33	2.66	2.66	2.60	2.50	2.50	2.40	2.66	2	2.16	2.20	2.50	2.50	2.16	2.50

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

UNIT I - INTRODUCTION **9hrs**

Structural parts and functions of ship and its classification rules**;** Structural Design of Bottom, Side Shell, Bulkhead, deck, fore-end, aft-end structures.
Dynamic analysis; Representation of a system; fluctuating force or forcing function as input; response of a system to the input; Classification of forces; mathematic representation of the forces

UNIT II - SINGLE DEGREE FREEDOM SYSTEMS **9hrs**

Mechanical system; Equivalent stiffness; Equivalent mass; spring-mass-dashpot system; Single degree freedom system (SDF); free vibration of undraped SDF system; forced vibration of undamped SDF system; forced damped SDF system

UNIT III – MULTI – DEGREE FREEDOM SYSTEMS **9hrs**

Two degree freedom system; free and forced vibration of two degree freedom system; multi degree freedom system. Method of mode summation

UNIT IV – SHIP HULL VIBRATION **9hrs**

Continuous system; Holzer's method, Mjkyle Stadt method; Concept of added mass in ship hull vibration; Schlick's formula; Todd's formula; Kamai's formulas SR94 expression; Stodola's method for ship hull vibrations

UNIT V - DESIGN CONSIDERATIONS **9hrs**

Estimate of N2v, N2H and higher mode frequencies; Hull Resonance Diagram; Selection of Engine rpm; Selection of number of Blades on a Propeller; Engine Mount Design; Location finding for electronics instrument on-board -a vessel; if required structural rearrangement

Total: 45 Hours

TEXTBOOKS

1. W.T. Thomson, Mechanical Vibration, 1953.
2. Edward V. Lewis, Principles of Naval Architecture (Vol. 2 - Resistance, Propulsion and Vibration), 3rd edition, SNAME, 1988.

REFERENCES

1. Owen. F. Hughes and JeomKee Paik, Ship Structural Analysis and Design, 1st edition, SNAME, 2008.

SHIP CONSTRUCTION

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code	**Course Name**	L	T	P	C	
232NA1A75TU	**CAD/CAM IN SHIPBUILDING**	3	0	0	3	
Year and Semester		**Contact hours per week** (3 Hrs)				
Prerequisite course	Engineering Graphics					
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 mathematics of geometric design. 2. To generate smooth and fair curves, surfaces and volumes of marine hull form design.					

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Course Outcomes	After completion of the course, the students will be able to 1. Illustrate mathematical interpretation around computer graphics. 2. Explain the techniques used in fairing a surface. 3. Develop codes for mathematical equations of surfaces. 4. Apply constructive solid geometry for generation of surfaces. 5. Develop CNC machine codes for plate cutting. 6. Utilize software and computational tools for CAD/CAM tasks in ship building.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	3	3	-	3	-	-	-	-	-	-	-	3	-	3
CO4	3	3	3	-	3	-	-	-	-	-	-	-	3	-	3
CO5	3	3	3	-	3	-	-	-	-	-	-	-	3	-	3
CO6	3	3	3	-	3	-	-	-	-	-	-	-	3	-	3
Avg.	3	3	3	-	3	-	-	-	-	-	-	-	3	-	3

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

UNIT 1 – INTRODUCTION **9 Hrs**

Introduction and classification of geometric modeling forms for curves, surfaces and volumes; differential geometry of curves and surfaces; introduction to spline curves; Bezier splines; Uniform/non-uniform Rational B-splines; and fitting, fairing

UNIT 2 – SURFACE GENERATION **9 Hrs**

Curve generation, Ship Curve design, Integration and fairing techniques for curves, Surface representation, Analytical and parametric representation of surfaces

UNIT 3 – SOFTWARE GENERATION AND TESTING **9 Hrs**

Programming and checking for accuracy of area, volumes and various geometrical forms using appropriate programming software

UNIT 4 – COMPUTER AIDED DESIGN **9 Hrs**

Introduction to blending surfaces; intersection problems in geometric design; offsets of parametric curves, Generation of surfaces and volumes; constructive solid geometry

UNIT 5 – APPLICATION OF CNC **9 Hrs**

Introduction to CNC programming and application, Principles of numerical control, Manual programming, Introduction about preparatory codes (G & M codes)

Total : 45 Hours

TEXT BOOKS

1. D. F. Rogers and J. A. Adams , Mathematical Elements for Computer Graphics, 2nd edition, Tata McGraw-Hill, India,1989.
2. G. Farin , Curves and Surfaces for CAGD: A Practical Guide, The Morgan Kaufmann Series in Computer Graphics, 5th edition, Morgan Kaufmann, USA, 2001

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

REFERENCES

1. N. M. Patrikalakis and T. Maekawa, Shape Interrogation for Computer Aided Design and Manufacturing, Springer,2010.
2. John Horvath, Jonathan M. Ross, "Evaluation of Shipbuilding CAD/CAM/CIM Systems - Phase II (Requirements for Future Systems), National Steel and Shipbuilding Co San Diego CA, 1977.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code 232NA1A75TV	**Course Name** **STATUTORY REGULATIONS AND CLASSIFICATION RULES**	L	T	P	C
		3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)			
Prerequisite course	Engineering Graphics				

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

Course Objectives	To understand the role of IMO and classification societies - the relevance of codes & conventions in ship design & shipbuilding.
Course Outcomes	After completion of the course, the students will be able to 1. Explain the importance of classification society in shipbuilding. 2. Apply IMO conventions in ship design. 3. Utilize IMO codes in ship design. 4. Plan safety survey and draft survey. 5. Explain statutory survey and periodic survey. 6. Apply technical guidelines, rules and regulations offered by classification societies and IMO.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	2	3	-	-	-	-	-	-	2	2
CO2	3	3	-	-	2	3	3	3	-	2	-	3	3	3	3
CO3	3	3	3	-	2	3	3	3	-	2	-	3	3	3	3
CO4	3	3	-	-	2	3	3	3	-	2	-	3	3	3	3
CO5	3	3	-	-	2	3	3	3	-	2	-	3	3	3	3
CO6	3	2	-	-	2	3	3	3	-	2	-	3	3	3	3
Avg.	2.8	2.8	3	-	2	2.8	3	3	-	2	-	3	3	2.8	2.8

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

UNIT I - INTRODUCTION TO RULES AND REGULATIONS **9 Hrs**

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

UNIT 2 - IMO CONVENTIONS **9 Hrs**

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

UNIT 3 - IMO CODES **9 Hrs**

FSS, LSA and ISM codes and their applications.

UNIT 4 - CLASS SURVEY **9 Hrs**

Introduction to safety survey, Draft survey-Cargo survey-Refit survey

UNIT5 -STATUTORY SURVEY **9 Hrs**

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

Total : 45 Hrs.

REFERENCES

1. Life –Saving Appliances inc. LSA code, IMO,2017.
2. IACS, General Dry Cargo Ships-Guidelines for Surveys, Assessment and Repair of Hull Structures(IACS Rec 55) ,IMO, 2017.
3. MARPOL and SOLAS Code, 4th Edition, 2017.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**					
Course Code **232NA1A75TW**	**Course Name** **SHIPYARD PRACTICES AND PROJECT MANAGEMENT**			L	T	P	C
				3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)					
Prerequisite course	Engineering Graphics						
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**			
				✓			
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**			

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Course Objectives	To understand shipyard practices related to quality and production.
Course Outcomes	After completion of the course, the students will be able to: 1. Explain shipyard practices in Indian and global scenario. 2. Illustrate the principles in the planning, production, quality control and project management. 3. Develop a shipyard layout to maximize productivity for Indian conditions. 4. Develop a project schedule for ship construction/repair. 5. Evaluate industrial relations and personnel management. 6. Propose the general project planning and project scheduling

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	3	-	3	3	-
CO2	3	-	-	-	3	2	-	-	2	-	3	-	3	3	-
CO3	3	3	3	3	3	2	2	3	2	-	3	-	3	3	-
CO4	3	3	3	3	3	2	2	3	2	-	3	-	3	3	-
CO5	3	3	3	3	3	2	-	3	2	-	3	3	3	3	-
CO6	3	3	3	3	3	2	2	3	2	-	3	3	3	3	-
Avg.	3	3	3	3	3	2	2	3	2	-	3	3	3	3	-

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

UNIT I - INTRODUCTION TO SHIP YARD ACTIVITIES 9hrs

Organizational Structure of Shipyards, Functional Departments of Shipyard- Production, Planning, Material, Financial, HR and Administration, Yard Utility, Various activities in Shipyard- Shipbuilding and Ship Repair. National and Global Shipbuilding Activities- Economic trend in shipbuilding activity

UNIT II - SHIP BUILDING PROCESS 9hrs

General Process Planning, Principles of Design for Production, Production based structural assembly plan, Process Planning-Scheduling , Monitoring and Controlling, Material Planning and Contol, Quality Assurance Process in Shipyard- (Receipt Inspection, Test Certificates, Online quality Checks, QA format/check list preparation, Class Survey), Welding Inspections; Pressure testing of Tanks; Basin /Sea Trials and Delivery formalities- Understanding the importance of environmental considerations in ship construction

UNIT III – SHIPYARD LAYOUT AND PRODUCTIVITY 9hrs

Shipyard Capacity Planning- Productivity in Shipyard- Measurement and Monitoring, Shipyard Capacity estimation; Shipyard Layout- Factors affecting, design of shipyard layout, Production facility layout, Developing Shipbuilding Strategy; Modern Shipbuilding facilities;

Automation in shipbuilding

UNIT IV- PROJECT MANAGEMENT **9hrs**

General Project Planning, Project Scheduling, Application of models for process planning, scheduling and control - Gantt charts, CPM & PERT, Scheduling and Resource planning, Risk Management in Shipbuilding Projects, Performance Measurement and Reporting and its tools

UNIT V – INDUSTRIAL AND HUMAN RELATIONS **9hrs**

Shipyard Management, Personnel Management, Human Relations and its importance, Employee Training and Development, Managing Remote Work and Virtual Teams ,Contract Management, Managing Owners and Classification Society, Managing Vendors and subcontractors, CSR activities, Labour laws and regulatory bodies

Total: 45 Hours

TEXTBOOKS:

1. Project Management - Shipyard Management Planning, Engr. Khairulmuzammil Yuzri Califa7seas Maritime Academia Handbook - Part 3: Operation, Maintenance And Repair 2016
2. Shipyard Project Management, Fernando Remolina 2017 by y International Institute of Executive Careers
3. Storch R. Lee, Hammon C.P. & Bunch H.M..; Ship Production, Cornell Maritime Press, Maryland, USA, 1988
4. Taggart; ship design and construction, SNAME chapter 15, 1980
5. Buffa, Modern production operations management, 6th edition, Wiley 1980.

REFERENCES:

1. Shipbuilding Management by George Bruce 2021, Springer publication
2. Eyres D.J.; Ship Construction William Heinemann Ltd, London, 1982
3. Dormidontov V. K. & et.al; Shipbuilding Technology, Mir publishers, Moscow

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code 232NA1A65TX	**NON- DESTRUCTIVE TESTING**	L	T	P	C
		3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)			

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

Course Objectives

The main objective of the course is to impart knowledge on basic principles of various NDT methods, fundamentals, discontinuities in different product forms, importance of NDT, applications, limitations of NDT methods and techniques and codes, standards and specifications related to non-destructive testing technology

Course Outcomes

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

1. Explain the Visual Testing method to assess the welding defects.
2. Outline the methodology to carry out Liquid Penetrant test and properties of various liquids
3. Explain the principles of Magnetic particle testing method
4. Demonstrate the working principle of Radiographic testing method
5. Analyze ultra -sonic testing and their calibration methods.
6. Assess the quality of welding using non-destructive testing methods

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	-	-	-	-	-	-	2	2	2
CO2	3	-	-	2	-	2	-	-	-	-	-	-	2	2	2
CO3	3	-	-	-	-	2	-	2	-	-	-	-	2	2	2
CO4	3	-	2	2	-	2	-	-	-	-	-	-	2	2	2
CO5	3	-	2	2	-	2	-	2	-	-	-	-	2	2	2
CO6	3	-	2	2	-	2	-	2	-	-	-	-	2	2	2
Avg.	3	-	2	2	-	2	-	2	-	-	-	-	2	2	2

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

UNIT I - Visual Testing **9hrs**

Fundamentals of Visual Testing – vision, lighting, material attributes, visual perception, direct and indirect methods – Inspection objectives, sampling plan, inspection pattern etc – classification of indications for acceptance criteria - Codes, Standards and Specifications (ASME,ASTM,AWS etc.)

UNIT II - Liquid Penetrant Methodology **9hrs**

Principles – types and properties of liquid penetrants – developers – advantages and limitations of various methods - Preparation of test materials – Application of penetrants to parts, removal of excess penetrants, post cleaning –solvent removable,–Interpretation and evaluation of test results - dye penetrant process

UNIT III – Magnetic Particle Testing **9hrs**

Theory of magnetism –surface strength characteristics – Depth of penetration factors – Circular and longitudinal magnetization techniques, current calculation, Interpretation and evaluation of test indications – applicable codes and standards.

UNIT IV – Radiographic Testing **9hrs**

X-ray and Gamma-Ray radiography, Their principles, methods of generation, Industrial radiography techniques, inspection techniques, applications, limitations, Types of films, screens and penetrameters. Interpretation of radiographs, Safety in industrial radiography.

UNIT V - Ultra Sonic Testing Method **9hrs**

Basic principles of sound propagation, , Principle of UT, methods of their advantages and limitations, Piezoelectric Material, Various types of transducers/probe, Calibration methods, use of standard blocks, Thickness determination by ultrasonic method, limitations acoustic emission testing – principles of AET and techniques

Total: 45 Hours

TEXTBOOKS:

1. Non-Destructive Examination and Quality Control, ASM International, Vol.17, 9th edition (1989)
2. J. Prasad and C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, Tata McGraw-Hill Education, 2nd edition (2011).
3. B. Raj, T. Jayakumar and M. Thavasimuthu, Practical Non Destructive Testing, Alpha Science International Limited, 3 rd edition (2002).
4. T. Tangachari, J. Prasad and B.N.S. Murthy, Treatise on non-destructive testing and evaluation,Navbharath Enterprises, Vol.3, (1983).

REFERENCES:

1. C. Hellier, Handbook of NonDestructive Evluation, McGraw-Hill Professional, 1st edition (2001).
2. J. Thomas Schmidt, K. Skeie and P. Maclntire, ASNT Non Destructive Testing Handbook: Magnetic Particle Testing, American Society for Nondestructive Testing, American Society for Metals, 2nd edition (1989).
3. V. S. Cecco, G. V. Drunen and F. L. Sharp, Eddy current Manual: Test method, Vol.1, Chalk River Nuclear Laboratories (1983).
4. B.P.C. Rao, Practical Eddy Current Testing, Alpha Science International Limited (2006).

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5. N. A. Tracy, P. O. Moore, Non-Destructive Testing Handbook: Liquid Penetrant Testing, Vol. 2, American Society for Non-destructive Testing, 3rd edition (1999).

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**				
Course Code 232NA1A75TY	**ADVANCED SHIP TECHNOLOGY**	L	T	P	C
		3	0	0	3
Year and Semester		**Contact hours per week** (3 Hrs)			
Prerequisite course	NIL				

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

Course Objectives	To understand the applications of data analytics and AI in ships.
Course Outcomes	After completion of the course, the students will be able to: 1. Explain rules and regulations of ship automation systems. 2. Illustrate applications of data analytics in ship operations. 3. Understand machine learning methods in ship applications. 4. Illustrate deep learning methods in ship applications. 5. Apply machine learning and deep learning methods in shipbuilding and shipping. 6. Apply data analytics in shipbuilding and shipping

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	3	3	3	-	-	2	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	2	-	-	-	3	3	3
CO3	3	3	3	3	3	-	-	-	2	-	-	-	3	3	3
CO4	3	3	3	3	3	-	-	-	2	-	-	-	3	3	3
CO5	3	3	3	3	3	3	-	-	2	-	-	3	3	3	3
CO6	3	3	3	3	3	3	-	-	2	-	-	3	3	3	3
Avg.	3	3	3	3	3	3	-	-	3	-	-	3	3	3	3

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

UNIT I - INTRODUCTION **9hrs**

History of Unmanned ships, Different levels of Automation, General Rules and regulations of autonomous ships, I.O.T, Digital twins, Reliability of automation systems, Collision Regulations.

UNIT II- Data Analytics Applications in Ships **9hrs**

Probability and Statistics for Data Analytics – data distribution, univariate analysis, bivariate analysis, hypothesis testing; standardization and normalization of data; multi-collinearity study; association rule.

UNIT III – Machine Learning (ML) Applications in Ships **9hrs**

Supervised learning - Regression (simple linear regression, multiple linear regression), classification (K-nearest neighbour, decision tree, support vector machine, random-forest algorithm).

Unsupervised learning – cluster analysis (hierarchical clustering, k-means) and principal component analysis

UNIT IV – Deep Learning (DL) Applications in ships **9hrs**

Introduction to Neural Network; perceptron modelling; neural network architecture – weight and non-linear function selection; modelling of hidden layer; RNN and CNN applications in ships, advances in deep learning.

UNIT V- Applied ML and DL in ships **9hrs**

Supervised learning – predictions of ship dimension and engine RPM; fuel prediction and route optimization. Deep learning – object detection and collision avoidance.

Total: 45 Hours

TEXTBOOKS:

1. A classical approach to Artificial Intelligence, Munesh Chandra Trivedi, Khanna Publications
2. Artificial Intelligence and Machine Learning, Chandra S.S. & H.S. Anand, Phi Publications
3. Internet of Things, Jeeva Jose, (ISBN: 978-93-86173-591), Khanna Publishing house
4. Autonomous Vehicles and Future Mobility, Pierluigi Coppola, Domokos Esztergar-Kiss, (ISBN: 978-01-28176-962), Elsavier, 11th June 2019.

REFERENCES:

1. Data Science & Analytics, V.K.Jain, Khanna publishing House
2. A Classical Approach to Artificial Intelligence, Munesh Chandra Trivedi, Khanna Publications

PROGRAM	B.E.-Naval Architecture & Offshore Engineering					
Course Code	Course Name	L	T	P	C
232NA1A75TR	**COMPUTER AIDED STRUCTURAL DESIGN (FEA)**	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 Objectives	To understand applications of Finite Element Method (FEM) in ship structural analysis.				
Course Outcomes	After completion of the course, the students will be able to: 1. Explain the static and kinematic indeterminacy of structures. 2. Apply the virtual work and energy-based methods to structural problems. 3. Outline flexibility and stiffness matrix methods for structural analysis. 4. Apply Finite Element Method to structural problems. 5. Apply Finite Element Method to ship structures. 6. Design ship structures using Finite Element Method.					

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	2	2	2	-	-	-	-	3	3	3
CO2	3	3	2	-	-	-	-	2	-	-	-	-	3	3	3
CO3	3	3	3	-	-	2	2	3	-	-	-	-	3	3	3
CO4	3	3	3	-	-	2	2	3	-	-	2	2	3	3	3
CO5	3	3	3	3	2	2	2	2	-	-	-	3	3	3	3
CO6	2	2	2	2	2	2	2	-	-	-	-	3	3	3	3
Avg.															

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

UNIT I - INTRODUCTION TO SHIP STRUCTURAL ANALYSIS **9 Hrs**

Basic concepts; Types of structure; Force displacement relationship; Static and kinematic indeterminacy; objectives and general approach in ship structural analysis.

UNIT II- ENERGY BASED METHODS **9 Hrs**

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Principles of virtual work; Castigliano's theorem; energy-based methods; flexibility and stiffness matrix methods; formation of system of equations.

UNIT III - MATRIX METHODS **9 Hrs**

Determination of member and joint displacements; equivalent joint loads, stiffness matrix; deformation matrix; boundary conditions; effect of temperature variations; lack of fit, etc.

UNIT IV – FINITE ELEMENT METHOD **9 Hrs**

Introduction to finite element method; Advantages and disadvantages, Beam element; plane stress; plate bending.

UNIT V- FEM APPLICATIONS TO SHIP STRUCTURES **9 Hrs**

Application of FEM to ship structure; deck beams and deck girders; frames; double bottoms; bulkheads; deck and side shell.

Total: 45 Hrs

TEXTBOOKS:

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

REFERENCES:

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

PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code	Course Name	L	T	P	C
232NA1A75TS	**ADVANCED SHIP DESIGN**	3	0	0	3
Year and Semester	IV Year (semester VII)	Contact hours per week			

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Prerequisite course	NIL		(3Hrs)	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objectives	1. To understand selection of machinery, piping, electrical and communication equipment of a ship. 2. To understand cost estimation and contracts in shipbuilding.			
Course Outcomes	After completion of the course, the students will be able to: 1. Develop the general arrangement plan of ship. 2. Select machinery and propulsion systems. 3. Design of hull and machinery piping systems. 4. Estimate the electrical load, select navigational and communication equipment. 5. Estimate the shipbuilding cost. 6. Develop a shipbuilding contract.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	-	-	-	-	-	-	3	3	-
CO2	3	3	3	3	-	2	2	-	-	-	-	-	3	3	2
CO3	3	2	3	2	3	2	2	3	-	-	-	-	3	3	2
CO4	3	3	3	2	3	2	2	-	-	-	-	-	3	3	-
CO5	3	3	3	2	3	2	-	3	2	-	-	-	3	3	-
CO6	3	3	3	2	2	2	-	3	3	2	2	-	3	3	-
Avg.															

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

UNIT I - SHIP DRAWINGS AND PLANS **9 Hrs**

General arrangement Plan, generation of lines plan – methods, Class and Statutory drawings.

UNIT II - MACHINERY SELECTION, INSTALLATION AND PROPULSION SYSTEM 9 Hrs

Selection of Main Machinery, Selection of propeller, Selection of Rudder and Steering Gear, Selection of Auxiliary Machinery.

UNIT III – PIPING SYSTEMS AND OUTFITTING **9 Hrs**

Design of piping systems, Ballast and bilge water piping system, fuel oil system, fresh water system, seawater system, Deck outfitting items, bollards, chocks, fair leads.

UNIT IV – BASICS OF ELECTRICAL, NAVIGATION AND COMMUNICATION EQUIPMENT SELECTION **9 Hrs**

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

UNIT V – COST ESTIMATION **9 Hrs**

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

Total: 45 Hrs

TEXTBOOKS:

1. D.G.M Watson, Practical Ship Design, 1st, Elsevier Science Ltd., 1998.
2. Robert Taggart, Ship Design & Construction, SNAME, 1980.

REFERENCES:

1. E. C. Tupper, K. J. Rawson, Basic Ship Theory (Vol. 2- Ship Dynamics and Design), 5th edition, Butterworth-Heinemann(Elsevier), 2001.
2. Edward V. Lewis, Principles of Naval Architecture (Vol. 1 - Stability and Strength), 3rd edition, SNAME, U.S.A, 1988.
3. Edward V. Lewis, Principles of Naval Architecture (Vol. 2 - Resistance, Propulsion and Vibration), 3rd edition, SNAME, 1988.
4. Edward V. Lewis, Principles of Naval Architecture (Vol. 3 - Motions in waves and controllability), 3rd edition, SNAME, 1988.

PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code	Course Name	L	T	P	C
238NA1A28TB	ENVIRONMENTAL SCIENCE	2	0	0	0
Year and Semester		Contact hours per week (2Hrs)			
Prerequisite course	Nil				

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

Course Objectives	The purpose of this course is to provide knowledge about our ecosystem biodiversity, pollution prevention of pollution and save natural resources
Course Outcomes	After 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	-	-	-
Avg.	-	-	-	-	-	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

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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; India 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 Hrs

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 Publishing, New Delhi.
5. B.S. Chauhan. 2015. Environmental Studies. Laxmi Publications, New Delhi.

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PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code	Course Name	L	T	P	C
238NA1A38TC	INDIAN CONSTITUTION	2	0	0	0
Year and Semester		Contact hours per week (2Hrs)			
Prerequisite course	Nil				

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

Course Objectives

1. To understand Indian Constitution and their functions.
2. To understand non – institutional political processes and political economy.

Course Outcomes

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

1. Explain the salient features of the constitution.
2. Compare the union and state executive positions and legislative procedures.
3. Illustrate the salient features of union-state legislative.
4. Explain the political economy and its development of the Nation.
5. Demonstrate the changing nature of Indian Party system.
6. Interpret the knowledge of Indian constitution in life.

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	3	3	3
CO2	3	-	-	-	-	3	3	3	3	3	3	3	3	3	3
CO3	3	-	-	-	-	3	3	3	3	3	3	3	3	3	3
CO4	3	-	-	-	-	3	3	3	3	3	3	3	3	3	3
CO5	3	-	-	-	-	3	3	3	3	3	3	3	3	3	3
CO6	3	-	-	-	-	3	3	3	3	3	3	3	3	3	3
Avg.	3	-	-	-	-	3	3	3	3	3	3	3	3	3	3

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

UNIT 1: INTRODUCTORY **6 Hrs**

Salient feature of the constitution;Nature of India Federalism : Preamble, Citizenship & State; Fundamental rights, directives principles and fundamental duties.

UNIT II: UNION AND STATE EXECUTIVE **6 Hrs**

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President, Governor- Election, appointment, powers, position, council of ministers, Prime Minister, Parliamentary system of Government Union and State Legislative; Lok Sabha, Rajya Sabha, Vidhan Sabha &VidhanParishad - Composition; Speaker, Chairman, Privileges, Legislative procedure.

UNIT III : UNION **6 Hrs**

State Judiciary - Supreme Court & High Court, Composition & Powers, Writs. Union - State Legislative Relationship – Distribution of Legislative Powers; Administrative & Financial Relationship.

UNIT IV : POLITICAL ECONOMY **6 Hrs**

National Integration and Problem of National Building Political Economy of Development: Challenges of nation building –state against democracy.

UNIT V : CHANGING NATURE OF THE INDIAN PARTY SYSTEM **6 Hrs**

Significance of the Indian Model of Political System, Party system typology – Changing nature of Indian Party system Concept of one party dominance and the Congress system National and Regional parties; Ideology organization Leadership patterns and factionalism Elections, political participation and Voting behaviour Interest and Pressure groups.

TOTAL: 30 Hrs

TEXT BOOKS

1. DurgadasBasu ,Introduction to the Constitution of India, LexisNexis 1st edition 2013.
2. Madhav Khosla, The Indian Constitution, Oxford University Press, New Delhi , 2012.

REFERENCES

1. Brij Kishore Sharma, Introduction to the Indian Constitution, PHI, New Delhi, latest edition.
2. Rajini Kothari, Rethinking Democracy, Orient Longman, New Delhi, 2005.

PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code 238NA1A48TD	Course Name ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L 2	T 0	P 0	C 0

Document Prepared in "Board of studies" held on Date:19.07.2023	Document Approved in "Academic council" held on Date:22.11.2023

Year and Semester		**Contact hours per week** (2Hrs)		
Prerequisite course	Nil			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
				✓
Course Objectives	1. To impart knowledge on introduction to Indian knowledge systems on traditions connecting society and nature. 2. To provide knowledge on holistic life style in modern society with rapid technological advancements and societal disruptions.			
Course Outcomes	After completion of the course, the students will be able to 7. Explain basics of Indian Knowledge Systems. 8. Outline on the Indian perspective of modern scientific world-view. 9. Illustrate the principles and practice of Yoga and holistic health care system practiced in India. 10. Infer on philosophical traditions existed/exists in India. 11. Identify Indian linguistic and artistic traditions. 12. Summarise on linguistic and artistic traditions of India.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	2	2	2	2	-	2	-	-	-
CO2	-	-	-	-	-	2	2	2	2	2	2	2	-	-	-
CO3	-	-	-	-	-	2	2	2	2	2	2	2	-	-	-
CO4	-	-	-	-	-	3	2	2	2	2	2	2	-	-	-
CO5	-	-	-	-	-	2	2	2	2	2	2	2	-	-	-
CO6	-	-	-	-	-	2	2	2	2	2	2	2	-	-	-
Avg.	-	-	-	-	-	2.20	2.00	2.00	2.00	2.00	2.00	2.00	-	-	-

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

UNIT 1: INDIAN KNOWLEDGE SYSTEMS AND TRADITIONAL KNOWLEDGE **6 Hrs**

Diverse nature of Traditional Knowledge System, Astronomy in India, Chemistry in India, Mathematics in India, Metallurgy in India, Plant and Animal Science in Ancient India, Indian Traditional Knowledge on Environmental Conservation; The historical evolution of medical tradition in ancient India

UNIT II: INDIAN PERSPECTIVE OF MODERN SCIENTIFIC WORLD-VIEW 6 Hrs

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The diverse cultural contexts of scientific discovery and invention in ancient and medieval Indian history; Conventional Euro-centric view of science and its origins; interdisciplinary and comprehensive exploration of the scientific heritage of India

UNIT III: BASIC PRINCIPLES OF YOGA AND HOLISTIC HEALTH CARE SYSTEM **6 Hrs**

Ayurveda for Life, Health and Well-being, science and the practice of yoga therapy, scientific evidence base for yoga; Case studies for Yoga and holistic health care system.

UNIT IV: INDIAN PHILOSOPHICAL TRADITIONS **6 Hrs**

Astika systems: Sankhya, Yoga, Vedanta, Mimamsa, Nyaya, and Vaisheshika; Nastika: Jainism, Buddhism, and Lokayata; Indian Political Philosophy-Arthashastra; Thirukkural; Mahatma Gandhi-ahimsa (non-violence) and satyagraha.

UNIT V: INDIAN LINGUISTIC AND ARTISTIC TRADITIONS **6 Hrs**

Concept of Language, Philosophy of Language, Formal aspect of language; Phonology, morphology, syntax and semantics in ancient India; Aryan and Dravidian languages; Indian artistic traditions: Tanjore, Mysore, Bihar, Madhubani, Rajput, Pattachitra Paintings, Phad, Warli, Gond, Cheriyal Scrolls, Kalighat Paintings.

Total:30Hrs

TEXTBOOKS

1. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014.
2. Amit Jha. 2002. Traditional Knowledge System in India. Atlantic Publishers.

REFERENCES

1. Kapil Kapoor and Michel Danino, Knowledge traditions and practices of India, CBSE Publication, 2012.
2. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakashan, 2016.
3. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.

PROGRAM	B.E.-Naval Architecture & Offshore Engineering				
Course Code	Course Name	L	T	P	C
238NA1A58TE	GENDER SENSITIVITY	2	0	0	0

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Year and Semester		**Contact hours per week** (2Hrs)		
Prerequisite course	Nil			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
				✓
Course Objectives	1. To provide an overview of gender sensitivity 2. To provide basic understanding about contemporary gender related perspectives			
Course Outcomes	After completion of the course, the students will be able to 1. Outline the fundamental principles of gender sensitivity 2. Explain the about the various general spectrum 3. Explain the division of labor 4. Explain the contemporary perspectives of gender sensitivity 5. Gain knowledge on the justice, human rights and legal perspectives with reference to gender 6. Outline the emerging issues and challenges of the gender sensitivity			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	2	-	-	1	-	-	--	-
CO2	-	-	-	-	-	3	-	3	2	1	2	-	-	2	-
CO3	-	-	-	-	-	-	-	2	-	2	2	-	-	2	-
CO4	-	-	-	-	-	1	-	2	2	3	2	-	-	2	-
CO5	-	-	-	-	-	2	-	3	1	3	2	-	-	1	-
CO6	-	-	-	-	-	2	-	3	1	2	1	-	-	-	-
Avg.	-	-	-	-	-	1.5	-	2.5	1	1.8	1.6	-	-	1.1	-

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

UNIT I: FUNDAMENTALS OF GENDER SENSITIVITY **6 Hrs**

Gender: definition, nature, evolution, cultural, traditional and historical perspective

UNIT II: GENDER SPECTRUM **6 Hrs**

Gender: An overview of Biological, sociological and psychological conditioning

UNIT III: DIVISION OF LABOUR **6 Hrs**

Gender based division of labour-domestic work and use value;

UNIT IV: GENDER-CONTEMPORARY PERSPECTIVE **6 Hrs**

Gender justics and human rights, international perspective, constitutional and legal perspectives, Gender, Human Rights and Parity (parallel progress of both genders)

UNIT V: MEDIA AND EMERGING ISSUES IN GENDER **6 Hrs**

Print and Electronic Media and Gender Inequalities; Gender-Emerging issues and challenges; Case study on real life gender issues

Total:30Hrs

TEXT BOOKS

1. Rajya Lakshmi Kalyani et al. 2017. GENDER SENSITISATION, Himalaya Publishing House.

PROGRAM	**B.E.-Naval Architecture & Offshore Engineering**							
Course Code **238NA1A68PF**	**Course Name** **IN-PLANT TRAINING**				L 0	T 0	P 0	C 0
Year and Semester		**Contact hours per week** (N/A)						
Prerequisite course	Nil							
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**				
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**				
				✓				
Course Objectives	To acquire knowledge of the industry in which the in-plant training is done, and thereby improve the skills and career options.							
Course Outcomes	After completion of the course, the students will be able to: 1. Adapt appropriate work place behaviors. 2. Demonstrate domain knowledge suitable for job assignment. 3. Improve domain knowledge through experience gained during in-plant training. 4. Describe the organizational functions.							

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	5. Explain the in-plant training experience in terms of broader career prospects. 6. Compile an in-plant training report describing the work done.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	2	-	3	3	3	-	-	3	3	3
CO2	3	3	-	-	-	2	-	-	-	3	-	-	3	3	3
CO3	3	3	-	-	2	2	-	-	-	3	-	-	3	3	3
CO4	3	3	-	-	-	2	-	3	-	3	-	-	3	3	3
CO5	3	3	-	-	2	2	-	-	-	3	-	-	3	3	3
CO6	3	3	-	-	2	2	-	-	3	3	-	-	3	3	3
Avg.	3.00	3.00	-	-	2.00	2.00	-	3.00	3.00	3.00	-	-	3.00	3.00	3.00

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

A student must undergo an in-plant training for a minimum period as prescribed by the department in the relevant field of Naval Architecture or Offshore Engineering.

Total: N/A

TEXTBOOKS: N/A

REFERENCES: N/A