

UNIVERSITY OF MUMBAI
No.UG/387of 2008

CIRCULAR :-

The Principals of the affiliated colleges in Engineering , the Principals of the affiliated colleges in Science, the Captain Superintendent, Ministry of Surface, Transport, Training Ship 'Chankya', Government of India, Nerul, Navi Mumbai and the Director, Sir Mohamed Yusuf Seamen Welfare Foundation, Nhava, Panvel Taluka, Raigad District, Maharashtra - 410206 are hereby informed that recommendation made by the Dean, Faculty of Science, has been ~~has been~~ accepted by the Academic Council at its meeting held on 13th June,2008 vide Item No.4.29 and subsequently approved by the Management Council at its meeting held on 27th June,2008 vide Item No.13 and that, in accordance therewith, the Post-Graduate Advanced Diploma in Naval Architecture and Ship Building has been introduced by the University from the academic year 2008-2009.

Further, that in exercise of powers conferred upon the Management Council under Section 54(1) and 55(1) of the Maharashtra Universities Act,1994 it has made Ordinances 5771 and 5772 and Regulations 5897, 5898, 5899, 5900, 5901,5902,5903 and 5904 including scheme of examination and syllabus for the Post Graduate Advanced Diploma in Naval Architecture and Ship Building is as per Appendix and that the same has been brought into force with effect from the academic year 2008-2009.

MUMBAI-400 032
18th August, 2008

PRIN.K.VENKATARAMANI
REGISTRAR

To,

The Principals of the affiliated colleges in Engineering , the Principals of the affiliated colleges in Science, the Captain Superintendent, Ministry of Surface, Transport, Training Ship 'Chankya', Government of India, Nerul, Navi Mumbai and the Director, Sir Mohamed Yusuf Seamen Welfare Foundation, Nhava, Panvel Taluka, Raigad District, Maharashtra - 410206

A.C./4.29/13.06.2008
M.C./13/27.06.2008

No.UG/387- A of 2008, MUMBAI-400 032

18th August, 2008

Copy forwarded with compliments for information to :-

- 1) The Dean, Faculty of Science.
- 2) The Dean, Faculty of Technology.
- 3) The Controller of Examinations.
- 4) The Co-Ordinator, University Computerization Centre,


(D.H. KATE)
DEPUTY REGISTRAR
(U.G./P.G SECTION)

14/8
12/8
13/8



UNIVERSITY OF MUMBAI



Ordinances, Regulations,
Scheme of Examination
And

Syllabus for the
Advanced Diploma Course in
Naval Architecture And
Shipbuilding

(Introduced with effect from the academic year
2008-2009)

UNIVERSITY OF MUMBAI

P R E A M B L E

After years of slow growth, Shipbuilding and Marine related industry is witnessing a tremendous spurt in shipbuilding all over the world, including India. Seven or eight new shipyards are being set up around the Indian coast and every month there are announcements of more such projects. An estimated Rs. 26,000 Crore outlay has been committed to new ship building yards in India by well known Indian and Foreign companies.

There is an acute shortage of qualified and trained personnel in these fields. In Shipbuilding alone there is an estimated shortage of 10000 professionals including Naval Architects. Against a requirement of about 1000 Naval Architects, we in India are producing only about 200 annually. Many leave to join foreign shipyards at attractive wages. This shortage of qualified naval architects and other skilled people can result in shipbuilding and repair business moving away from India.

India's vast coastline and strategic position in the Indian Ocean demands various capabilities for our nation. The Indian Maritime Doctrine of 2004 spells these out in detail. An energetic knowledge base for all matters maritime is essential. It is hoped that the proposed Post Graduate Diploma Course will fill the acute demand for Naval Architects and ship designers and shipbuilders from the industry. Also we hope this will fill the urgent need for research scholars required in our specific national needs for appropriate crafts and vessels with in India's continental shelf and in our areas of commercial influence.

There is thus, tremendous scope for a One Year Advanced Diploma Course in Naval Architecture and Ship Building to give required depth of underpinning knowledge and training in all aspects of Ship Design, and shipbuilding. The intake would be graduate Engineers from any stream or B.Sc. Graduates in Maritime / Nautical Science, Nautical Technology (I.D.E.). Mumbai being the center of shipping activities in India and being its premier port and also home to Mazagon Docks, Naval Shipyard and many private organizations in ship building and ship designing, can easily support such a course. In fact such courses are already being conducted privately on behalf of reputed ship-builders and designers. Many such trained students are working in India and abroad in reputed concerns.

This course has been developed keeping in mind demands of the shipbuilding industry and in close association with them.

UNIVERSITY OF MUMBAI

ORDINANCE & REGULATION RELATING TO ADVANCED DIPLOMA IN NAVAL ARCHITECTURE AND SHIPBUILDING.

O-5771---TITLE OF THE COURSE

THE COURSE SHALL BE TERMED ADVANCED DIPLOMA IN NAVAL
ARCHITECTURE AND SHIPBUILDING.

O-5772---STUDENTS ADMISSION ELIGIBILITY

B. E. / B. Tech in any Engineering stream from a University or equivalent.

B. Sc. Nautical Science / B. Sc. Maritime Science / B.Sc. Nautical
Technology (I.D.E.) or equivalent from a recognized University.

M.E.O. Class II or higher Certificate of Competency holders, Mates Phase
- II or higher Certificate of Competency holders.

Industry sponsored MSBTE Diploma holders or equivalent with minimum
Three Years experience in Shipbuilding / Ship Designing

R-5897---DURATION OF COURSE

One Year Full Time Divided Into Two Semesters Of 16 Weeks Each

R-5898---INTAKE CAPACITY

Total 60 Students.

Batch size for Practicals : 20

R-5899-TEACHING STAFF (QUALIFICATION & EXPERIENCE)

Principal / Director:

M.Tech. (Nav. Arch) or higher with minimum 7 years experience.

Extra-First Class Marine Engineer/Extra-Master Mariner with minimum 7 years experience.

Class - 1 Marine Engineer / Master Mariner (FG) with minimum 10 Years experience

B.Tech. (Nav. Arch); B.E./B.Tech (Marine) with minimum 15 years experience

Faculty :

For 1ST SEMESTER

Sr No.	Paper	Faculty	Weekly Workload	Semester Work Load	Qualification
1	Introduction to Naval Architecture	Full Time	3	45	B.E., B.Tech (Naval Arch.), *Marine Engr (Class-1), *Master Mariner (F.G.)
2	Marine Environment	Full Time	3	45	*Marine Engr (Class-1), *Master Mariner (F.G.)
3	Ship Hydrostatics & Stability	Full Time	5+ 3+ 1 = 9	135	B.E., B.Tech (Naval Arch.), *Marine Engr (Class-1), *Master Mariner (F.G.)
4	Ship Structure	Full Time	5+ 3+ 1 = 9	135	B.E., B.Tech (Naval Arch.), *Marine Engr (Class-1), *Master Mariner (F.G.)
5	Marine Propulsion Machinery	Full Time	3+ 2+ 1 = 6	90	*Marine Engr (Class-1)

(*) Note : MEO Class - 1 Engineers and Master Mariners (F.G.) should have a minimum work experience of 7 years after certification

Faculty :

For 2ND SEMESTER

Sr No.	Paper	Faculty	Weekly Workload	Semester Work Load	Qualification
1	Regulatory Framework for Shipping	Full Time	3+1=4	60	*Marine Engr (Class-1), *Master Mariner (F.G.)
2	Ship Hydrodynamics	Full Time	4+1=5	75	B.E., B.Tech (Naval Arch.), *Marine Engr (Class-1), *Master Mariner (F.G.)
3	Ship Design	Full Time	4+2=6	90	B.E., B.Tech (Naval Arch.), *Marine Engr (Class-1), Master Mariner *(F.G.)
4	Shipbuilding Technology	Full Time/Part Time	4+1=5	75	Shipwright, Practicing / Retired Shipbuilder (Naval Architect, Marine Engineer)
5	Marine Auxiliary Machinery	Full Time	4+2=6	90	*Marine Engr (Class-1)
6	Project	Full Time	6	90	B.E., B.Tech (Naval Arch.), *Marine Engr (Class-1), *Master Mariner (F.G.)

(*) Note : MEO Class - 1 Engineers and Master Mariners (F.G.) should have a minimum work experience of 7 years after certification

Training & Placement Officer

Qualifications : B.Tech (Nav. Arch.), Class-1 Marine Engineer, Master Mariner (Foreign Going). (One of the suitably qualified Naval Architects, Marine Engineer or Master Mariner faculty can also function as the Training and Placement Officer and can be paid extra for this work)

Laboratory Staff

1 Lab Assistant and 1 peon for Ship Design Laboratory

Qualifications :

Lab Assistant – B.Sc. in Physical Sciences or Engineering Diploma holders (MSBTE or equivalent) with certificate in CAD/CAM.

Peon – 10th pass.

WORKLOAD

The workload shall be as per R 5900 .

(as per table on page 4 & 5)

LIBRARY

The college / institution shall spend minimum Rs.5,00,000 in the first year on purchase of books and Rs. 25,000/- on journals and magazines as the initial investment on the library, thereafter the entire library fees collected from the students shall be invested on library as per university guidelines.

Apart from all the books mentioned in the syllabus, the Library should also have all the relevant IMO (International Maritime Organisation) and ILO (International Labour Organisation) Publications, all RINA (Royal Institute of Naval Architects) and SNAME (Society of Naval Architects and Marine Engineers) Publications.

EQUIPMENTS

Annexure - I

R-5901 SCHEME OF EXAMINATION

Examinations shall be conducted at the end of each SEMESTER by the University.

Theory examination for each paper shall be of 100 marks. Marks for Internal Assessment and Oral examinations will be as per the Scheme.

The Internal Assessment shall consist of Tutorials, Assignments and Unit Tests.

The Internal Assessment marks of students of the 1st and 2nd Semester shall be sent to the university by the respective college / institution before commencement of the semester examinations.

Theory examination for each paper, internal assessment and oral examination will be as per the scheme.

R-5902 The Candidates shall be examined in the following subjects for the 1st and 2nd Semester of the 1-Year Advanced Diploma in Naval Architecture

1st Semester:

1. Introduction to Naval Architecture
2. Marine Environment
3. Ship Hydrostatics and Stability
4. Ship Structure
5. Marine Propulsion Machinery

2nd Semester

1. Regulatory Framework for Shipping
2. Ship Hydrodynamics
3. Ship Design
4. Shipbuilding Technology
5. Marine Auxiliary Machinery
6. Project

UNIVERSITY OF MUMBAI

SCHEME OF EXAMINATION

COURSE: ADVANCED DIPLOMA IN NAVAL ARCHITECTURE AND SHIPBUILDING

ONE YEAR PROGRAMME

SEMESTER - II

Sr. No.	Paper	No. of Periods per week (60 minutes each)			Duration of Theory papers (Hours)	Examination Marks			
						Theory	Internal Assessment (as per table below)	Orals	Total
		Lecture	Assignments	Tutorial					
01.	Regulatory Framework for Shipping	3	1	-	3	100	50	50	200
02.	Ship Hydrodynamics	4	1	-	3	100	50	50	200
03.	Ship Design	4	2	-	3	100	50	50	200
04.	Ship Building Technology	4	1	-	3	100	50	50	200
05.	Marine Auxiliary Machinery	4	2	-	3	100	50	50	200
06.	Project*	-	6	-	-	-	100*	100*	200
Total		19	13	0		500	350	350	1200
		32							

THEORY EXAMINATION:

1. Question paper will comprise of total seven questions, each of 20 Marks. Student will attempt FIVE questions.
2. Question one will be compulsory and based on the entire of syllabus.
3. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

ORAL EXAMINATION:

Oral examination will be based on the entire syllabus of the paper including the Assignments. Equal weightage (50% each) will be given to marks of Internal and external examiners.

INTERNAL ASSESSMENT:

Internal Assessment shall consist of 4 Assignments, and 3 Unit Tests. Each Assignment will carry 15 marks and each Unit Test will carry 20 marks - two best unit tests out of three will be considered. The distribution of marks for internal assessment shall be as follows:

- Assignments : 60 Marks.
 - Unit Tests (2 best out of 3): 40 Marks.
 - Total Marks 100 Marks
- (This will be reduced to 50 Marks)

* NOTE: Students will spend minimum 6 hours per week on the Project.
For Assessment of Project work, 50% weightage will be given to Internal and External Examiners each.

STANDARD OF PASSING

6. A candidate who fails in any heads of passing (Theory paper, Internal Assessment, Orals or the Project) shall be allowed to reappear in the head in which he / she has failed for a period of up to Three years. But in that case his / her internal assessment marks shall be carried and shall not be entitled for any class on passing.

UNIVERSITY OF MUMBAI

SYLLABUS

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- I
01-PAPER: - Introduction to Naval Architecture			
Periods per week 1 Period of 60 min.	Lecture	3	
	Assignment	-	
	Tutorial	-	
Examination System		Hours	Marks
	Theory Examination	3	100
	Internal Assessment	-	-
	Oral Examination	-	-

Objective: To introduce candidates to various types of ships, shipping terminology, and history of shipping development

Detailed Teaching Syllabus

Sr. No.	Details	Hrs.
Module 01	1.1 Introduction to Ships:- Ships and their systems. Knowledge involved in the design, construction and operation of ships. Ship terms and nomenclature. Indian and worldwide shipping and shipbuilding industries.	6
Module 02	2.1 History of Ship Development:- History of ship development. Development of cargo ships, passenger ships and warships. Introduction to various types of ships.	3
Module 03	3.1 Cargo Ships:- General cargo ships. Bulk carriers. Container ships. Vehicle carriers. Roll on – roll off ships. Oil tankers. Chemical tankers. Liquefied gas carriers. Oil/bulk/ore carriers. Oil product/chemical carriers. Tug-barge systems. Barge carriers. Heavy lift ships. Lumber carriers. Passenger ships and ferries.	12
Module 04	4.1 Service Vessels :- Tugs and towboats. Dredgers. Floating docks. Work boats and other harbour craft. 4.2 Ocean Engineering Vessels and Structures:- FPSO vessels. Offshore support vessels. Offshore exploration and production platforms and vessels. Submersibles, AUVs and ROVs.	6
Module 05	5.1 Naval Vessels Naval surface ships : aircraft carriers, destroyers, frigates, corvettes, mine counter measure vessels and other warships. Submarines : conventional and nuclear.	9
Module 06	6.1 Advanced Marine Craft :- Multi-hull vessels. Planing Craft. Hydrofoil craft. Air cushion vehicles. Wing-in-ground effect craft. Hybrid concepts.	9

Text Books:

1. Ships and Naval Architecture, Munro-Smith, R., Institute of Marine Engineering, Science & Technology, ISBN 0-900976-68-3.
2. Introduction to Naval Architecture, Tupper, E.C., Butterworth-Heinemann, ISBN 0-7506-6554-8
3. Reeds Naval Architecture for Marine Engineers, Stokoe, E. A., Thomas Reed Publications, 0901281-39-5

References:

1. Ship Design and Construction, Lamb, T. (Editor), Society of Naval Architects and Marine Engineers, ISBN 0-939773-40-6
2. Dictionary of Marine Technology, Taylor, D.A., Butterworths
3. Elements of Shipping, Branch, Alan E., Chapman & Hall Ltd., 0-412-60460-4

UNIVERSITY OF MUMBAI

SYLLABUS

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- I
02-PAPER: - Marine Environment			
Periods per week (Period of 60 min.)	Lecture	3	
	Assignments	-	
	Tutorial	-	
		Hours	Marks
Examination System	Theory Examination	3	100
	Internal Assessment	-	-
	Oral Examination	-	-

Objective: Exposes candidates to sea and weather conditions in which the ships ply and factors to take into account when designing ships.

Detailed Teaching Syllabus

Sr. No.	Details	Hrs.
Module 01	1.1 Basis of Marine Environment :- Ocean Floor. Physical properties of sea water, fresh water and air. Ocean temperature. Atmospheric circulation and air/water interface.	3
Module 02	2.1 Ocean Currents :- Geostrophic current. Ekman current. Main Current systems. Upwelling and downwelling. Seiches. Tides.	3
Module 03	3.1 Local and Global Weather Issues :- Ice conditions. Tropical revolving storms. Weather fronts. Local weather issues. Trade Winds.	9
Module 04	4.1 Ocean Waves :- Regular waves. Theory of trochoidal waves. Sinusoidal waves. Group velocity. Energy in a wave. Higher order wave theory. Statistical representation of a seaway.	9
Module 05	5.1 World's Waterways :- Physical characteristics of major ocean basins and seas. Lakes and waterborne transportation. Inland waterways in India and the rest of the world. Suez, Panama and other major canals.	9
Module 06	6.1 Marine Corrosion :- General principles of corrosion and corrosion control. Electro-chemical nature of corrosion. Galvanic series. Forms of corrosion. Coatings and coating types. Cathodic protection. ICCP.	12

Text Books:

1. Introduction to Physical Oceanography, Knauss, J.A., Prentice-Hall, ISBN ...
2. Corrosion Engineering, Fontana, M.G., McGraw-Hill, ISBN ...

References:

1. Meteorology for ships officers – HMSO (Her Majesty's Stationery Office, UK)

SYLLABUS

Oral Examination	-	50
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Objective: This deals with the shape and form of the ships, Stability and Buoyancy of the ships

Detailed teaching syllabus		
Sr. No.	Details	Hrs.
Module 01	1.1 Ship Dimensions :- Measures of ship size. Main dimensions. Dimensions associated with the midship section. Sheer and camber. Moulded and extreme dimensions.	6
Module 02	2.1 Lines Plan :- Hull form geometry. Drawing of lines plan. Offset table. Lines fairing. Sectional area curve.	6
Module 03	3.1 Numerical Integration in Naval Architecture :- Trapezoidal, Simpson and Tchebycheff Rules. Application to calculation of areas, volumes, and first and second moments.	9
Module 04	4.1 Hydrostatic Particulars :- Waterplane area, centre of flotation and moments of inertia. Bonjean areas and moments. Displacement, centre of buoyancy and metacentres. Moment to change trim and tonnes per cm immersion. Hull form coefficients. Wetted surface. Empirical formulas for wetted surface and vertical centre of buoyancy. Capacity calculations.	18
Module 05	5.1 Equilibrium and Stability :- Equilibrium of floating bodies. Weight and buoyancy. Centre of gravity and centre of buoyancy. Concept of stability. Metacentric height. Righting moment and righting lever. Effect of hanging weights and free surfaces. Inclining experiment. GZ curve. Cross curves of stability. Wall sided formula and angle of loll. Dynamical stability. Heeling moments. Longitudinal stability and trim. Effect of change of density of water. Stability in docking and grounding. Grain stability. Intact stability criteria. Stability booklet.	18
Module 06	6.1 Damage Stability :- Damage stability. Effects of damage. Permeability of spaces. Subdivision. Calculation of equilibrium position and stability after damage. Lost buoyancy and added weight methods. Floodable length, permissible length and associated parameters. Damage stability criteria for various ship types. Probabilistic approach to damage stability.	18

List of Assignments:

1. Drawing of line plan from given offsets.
2. Hydrostatic calculations.
3. Determination of stability curves.
4. Preparation of Cross Curves of Stability.

(Note : Wherever possible, the assignments will be carried out using computers and available software.)

Text Books:

1. Introduction to Naval Architecture, Tupper, E.C., Butterworth-Heinemann, ISBN 0-7506-6554-8.
2. Basic Ship Theory, Rawson, K.J. and Tupper E.C., Longman Scientific and Technical, ISBN 0-582-30526-4.

References:

1. Principles of Naval Architecture, Vol. I, Lewis, E.V. (Editor), Society of Naval Architects and Marine Engineers, ISBN 0-939773-00-7.

SYLLABUS

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- 1
04-PAPER: - Ship Structure			
Periods per week 1 Period of 60 min.	Lecture	5	
	Assignments	3	
	Tutorial	1	
Examination System		Hours	Marks
	Theory Examination	3	100
	Internal Assessment	-	50
	Oral Examination	-	50

Objective: To understand strength of the ship and its various parts, during different sea conditions of ships operation, cargo work and damaged stability.

Detailed Teaching Syllabus

Sr. No.	Details	Hrs.
Module 01	1.1 Shipbuilding Materials:- Shipbuilding materials for hull and equipment. Rolled sections used in ship construction.	9
Module 02	2.1 Load on Ships Structure:- Static and dynamic loads. Longitudinal bending – vertical and horizontal. Transverse strength. Torsion. Racking, Panting and Pounding. Whipping and springing. Loads due to sloshing, docking, grounding and collision. Thermal stresses.	6
Module 03	3.1 Elements of ship structure :- Main elements of ship structure. Transverse and longitudinal stiffening. Seams and butts in plating. Modes of failure and load paths.	9
Module 04	4.1 Detailed Consideration of Ship Structure Bottom structure. Side structure. Decks. Bulkheads. Fore end structure. Aft end structure. Superstructure and deckhouses. Miscellaneous structural elements. Structural arrangements of different types of ships. Structural details.	24
Module 05	5.1 Longitudinal Strength Still water shear forces and bending moments. Wave shear forces and bending moments. Section modulus and bending stresses. Classification society approach.	9
Module 06	6.1 Calculation of Scantlings Principles of ship structural design. Classification society rules for scantling calculations. Introduction to advanced methods of structural analysis.	18

List of Assignments:

1. Longitudinal strength calculation.
2. Calculation of scantlings using classification society rules.
3. Drawing of a structural midship section
4. Drawing of Structural Details

Text Books:

1. Ship Construction, Eyres, D.J., Butterworth-Heinemann, ISBN 0-7506-4887-2.
2. Basic Ship Theory, Rawson, K.J. and Tupper E.C., Longman Scientific and Technical, ISBN 0-582-30526-4.
3. Reeds Ship Construction for Marine Students, Stokoe, E. A., Thomas Reed Publications, 0-900335-55-6

References:

1. Principles of Naval Architecture, Vol. I, Lewis, E.V. (Editor), Society of Naval Architects and Marine Engineers, ISBN 0-939773-00-7
2. Ship Design and Construction, Lamb, T. (Editor), Society of Naval Architects and Marine Engineers, ISBN 0-939773-40-6
3. Rules & Regulations for the Construction & classification of Steel Ships, Indian Register of Shipping
4. Ship Construction Sketches & Notes, Kemp & Young, Butterworth-Heinemann, 0-7506-3756-0

SYLLABUS

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- I
05-PAPER: - Marine Propulsion Machinery			
Periods per week 1 Period of 60 min.	Lecture	3	
	Assignments	2	
	Tutorial	1	
Examination System		Hours	Marks
	Theory Examination	3	100
	Internal Assessment	-	50
	Oral Examination	-	50

Objective: To know and understand all the machineries on board ships – main engines, auxiliary engines, safety equipment, cargo machinery, deck machinery and similar.

Detailed Teaching Syllabus

Sr. No.	Details	Hrs.
Module 01	1.1 Engineering Systems :- Engineering systems in a ship and their components. Layout of Main and Auxiliary Machinery in Engine Rooms of different ships. Layout of steam, air, F.O., Cooling water, Bilge & Ballast systems. Complete layout of all equipments and systems in the engine room. Propulsion plant: alternatives available, their advantages and disadvantages, factors considered in their selection. Introduction to equipment and system fit.	9
Module 02	2.1 Diesel Propulsion Plant :- Diesel engines : thermodynamics; low, medium and high speed engines both for propulsion and auxiliary purpose; construction of 2-stroke and 4-stroke engines of different makes; scavenging and supercharging systems, fuel injection equipment; other associated systems, emission control, electronic engines.	9
Module 03	3.1 Gas Turbines :- Gas turbines cycles, comparative advantages and disadvantages, general construction and design features both for propulsion and auxiliary purpose; twin shaft and twin spool machines. Layout of F.O. and cooling systems and equipments for the Gas turbine plant; Combined operation of gas turbines with diesel engines and steam turbines.	6
Module 04	4.1 Steam Propulsion Plant :- Thermodynamics. Boilers - construction and their accessories. Steam turbines – types, construction, condensers and other equipment for steam turbine. Nuclear propulsion.	6
Module 05	5.1 Electric Propulsion Plant :- Electric propulsion drives. Power converters. Superconducting motors. Magneto-hydrodynamic propulsion. Fuel cells.	6
Module 06	6.1 Power Transmission :- Shafting, bearings, thrust bearings, stern tube bearings, mechanical reduction gearing, clutches and couplings. Vibration in shafting. Shafting layout. Torsionmeters and thrust-meters.	9

List of Assignments:

1. Preparation of General Layout Plan of the Engine Room of a Motor Propulsion ship of about 20,000 KW power output.
2. Preparation of a General Layout plan of the Engine Room of a Steam propulsion ship of about 40,000 KW power output.
3. Preparation of a General Layout plan of the Engine Room of a Gas Turbine propulsion Naval ship of about 30,000 KW power output.
4. Preparation of a General Layout plan of the Engine Room of an all electric propulsion ship of about 20,000 KW power output.

Text Books:

1. Pounder's Diesel Engines & Gas Turbines.
2. The running and maintenance of Marine Machinery, Cowley Institute of Marine Engineers, London
3. Introduction to Practical Marine Engineering, Vol 1 & 2, Alan L. Rowen and Others, The Society of Naval Architects and Marine Engineers, 0-939773-48-1

References:

1. Marine Boilers, Milton
2. Marine Steam Engineering Knowledge, Fox and McBrine
3. Marine Engineering, Harrington, The Society of Naval Architects and Marine Engineers,

UNIVERSITY OF MUMBAI

SYLLABUS

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- II
01-PAPER: - Regulatory Framework for Shipping			
Periods per week Period of 60 min.	Lecture	3	
	Assignment	1	
	Tutorial	-	
		Hours	Marks
Examination System	Theory Examination	3	100
	Internal Assessment	-	50
	Oral Examination	-	50

Objective: To familiarize candidates with the regulatory regime involved in construction and operation of ships – Local, National and International.

Detailed Teaching Syllabus

Sr. No.	Details	Hrs.
Module 01	1.1 International, National and Local Maritime Authorities and their Functions:- IMO and its structure. Responsibilities of IMO. Function of MSC, MEPC and other committees. Structure of IMO Conventions. Adoption and amendments to Conventions and Protocols. Difference between Explicit and Tacit approvals. Resolutions and Circulars. Responsibilities of Maritime Administrations. Interaction between IMO and Maritime Administrations. Casualty Investigations. Port State Control	6
Module 02	2.1 SOLAS Convention:- History of SOLAS Convention. Introduction to 14 (12+2) chapters of SOLAS 74. Introduction to frequently used IMO Resolutions and Circulars as usually given in foot-notes of SOLAS 74. Introduction to Chapter II-1 & II-2 and details. Introduction to Chapter III and details. Introduction to Chapter IV and details. Introduction to Chapter V and details. Codes related to SOLAS i.e. ISM, ISPS, BC, IBC, IGC Codes.	9
Module 03	3.1 MARPOL Convention:- MARPOL 73 and Protocol 78. Details of Annex I. Details of Annex II. Details of Annex III. Details of Annex IV. Details of Annex V. Details of Annex VI. Codes related to MARPOL. Ballast Water and Antifouling Conventions.	9
Module 04	4.1 Tonnage Regulations:- Explanation of different types of tonnages. Evolution of tonnage measurement up to "Moorsom" method. Enclosed spaces, deducted spaces and exempted spaces. Qualified enclosed spaces. Gross and Net tonnages	2
	4.2 Load Line Convention:- Background, Samuel and Plimsoll mark. Terminologies and definitions – length, breadth, depth, draft, strength of hull. Further terminologies and definitions. Conditions for assignment of freeboard. Freeboard corrections.	4
Module 05	5.1 Other International Conventions and Codes; National Laws:- Dumping Convention. UNCLOS. High Speed Craft Code 2000. IMDG Code. EU directives. OPA 90. Indian MS Act.	6
Module 06	6.1 Classification Societies:- Origin of Classification Societies. Delegated power. Evolution of Recognised Organisation, Statutory surveys by and on behalf of Administration, Class Surveys, Survey on Advisory capacity, Details of class rules.	9

List of Assignments:

1. Preparation of a Record of Equipments for the cargo ship safety Radio Certificate (Form E) for a cargo ship of 20000 GT.
2. Load Line Calculations
3. Tonnage Calculations
4. Impact of stricter norms for ship recycling on ship design

Text Books:

1. Consolidated SOLAS 74 Convention, Latest Edition
2. MARPOL 73/78 Convention, Latest Edition
3. FSS & LSS Codes

References:

1. A set of Classification Society Rules for steel ships of any class.
2. Tonnage 69 and L.L. Convention 66.
3. Various IMO Codes : BC, IBC, IGC, IMDG, ISM, ISPS Codes

UNIVERSITY OF MUMBAI

SYLLABUS

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- II
02-PAPER: - Ship Hydrodynamics			
Periods per week 1Period of 60 min.	Lecture	4	
	Assignments	1	
	Tutorial	-	
Examination System		Hours	Marks
	Theory Examination	3	100
	Internal Assessment	-	50
	Oral Examination	-	50

Objective: to achieve propulsive efficiency under various sea and loading conditions.

Detailed Teaching Syllabus

Sr. No.	Details	Hrs.
Module 01	1.1 Ship Resistance :- Components of total resistance. Dimensional analysis. Frictional resistance, Reynolds number, form factor and effect of hull roughness. Wave resistance and Froude number. Boundary layer separation and eddy resistance. Other components of resistance. Air resistance. Model tests. Effective power and its estimation. Effect of shallow water. Hull form and ship resistance.	15
Module 02	2.1 Ship Propulsion :- Propeller action. Screw propeller geometry. Outline of propeller theory. Propeller characteristics. Hull propeller interaction. Cavitation. Strength of propellers. Propulsion model experiments. Propeller design. Speed trials. Unconventional propulsion devices.	15
Module 03	3.1 Seakeeping :- Ship motions in regular and irregular waves. Effects of ship motions – slamming, deck wetness, speed loss, forces on ship structure. Seakeeping model experiments. Motion stabilization. Seakeeping performance.	9
Module 04	4.1 Manoeuvring :- The turning of a ship. Equations of motion and linear theory. Types of rudder. Rudder design. Other manoeuvring devices. Manoeuvring model experiments and ship trials. Manoeuvring criteria.	9
Module 05	5.1 Hydrodynamics of Advanced Marine Craft :- Resistance of multi-hull vessels. Performance of planing craft in calm water and in rough seas. Hydrofoil craft – foil types and configurations. Resistance and propulsion of non-amphibious and amphibious air cushion vehicles.	6
Module 06	6.1 Unconventional Propulsion Devices :- Ducted propellers. Controllable pitch propellers. Contra-rotating and tandem propellers. Surface piercing propellers. Podded and azimuthing propellers. Waterjet propulsion. Flow improvement devices.	6

List of Assignments:

1. Estimation of Effective Power
2. Propeller Design
3. Rudder Design
4. Planing Craft Performance Calculations

Text Books:

1. Introduction to Naval Architecture, Tupper, E.C., Butterworth-Heinemann, ISBN 0-7506-6554-8.
2. Basic Ship Theory, Rawson, K.J. and Tupper E.C., Longman Scientific and Technical, ISBN 0-582-30526-4
3. Basic Ship Propulsion, Ghose J.P. & Gokarn R.P., Allied Publishers Pvt. Ltd., ISBN 81-7764-606-0

References:

1. Principles of Naval Architecture, Lewis, E.V. (Editor), Society of Naval Architects and Marine Engineers, ISBN 0-939773-00-7.
2. Dynamics of Marine Vehicles, Bhattacharya, R., Elsevier, ISBN ...

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- II
03-PAPER: - Ship Design			
Periods per week Period of 60 min.	Lecture	4	
	Assignments	2	
	Tutorial	-	
		Hours	Marks
Examination System	Theory Examination	3	100
	Internal Assessment	-	50
	Oral Examination	-	50

Objective: To understand application of all the aspects impacting a ship and its operation and to synthesize these in a holistic manner to have an optimization in ships design.

Detailed Teaching Syllabus

Sr. No.	Details	Hrs.
Module 01	1.1 Ship Design Processes :- Definition of Engineering design. Ship design approaches. Ship design process. Objectives and constraints in ship design. Stages in ship design. Design spiral.	4
Module 02	2.1 Effect of Mission on Ship Design :- Mission and ship types. Types of cargo and their requirements. Restrictions due to ports and waterways. Speed and endurance. Owner's technical requirements. Regulatory requirements.	4
Module 03	3.1 Selection of Main Dimensions :- Factors to be considered in selecting the main dimensions and hull form coefficients. Weight and volume equations. Weight limited, volume limited and linear dimension ships. Methods for estimating weights of hull steel, machinery, outfit and equipment.	8
Module 04	4.1 Hull Form Design :- Sectional area curve and load waterline. Shape of transverse sections. Bulbous bows. Types of stern and aft end arrangements. Methods for design of lines. Role of model tests and computational fluid dynamics.	16
Module 05	5.1 General Arrangement Design :- General arrangements of different types of ships. Effect of statutory regulations on general arrangement. Accommodation and habitability requirements. Access considerations. Location of machinery spaces, fuel tanks, fresh water tanks and water ballast tanks.	16
Module 06	6.1 Elements of Computer Aided Design:- Optimization methods in ship design. Computational Fluid Dynamics and its applications. Computer aided structural design methods.	12

List of Assignments:

1. Selection of main dimensions and other particulars of a ship.
2. Hull form design.
3. General arrangement design
4. Analysis of Ship Design Data

Text Books:

1. Elements of Ship Design, Munro-smith, R., Institute of Marine Engineers, ISBN 0-900976-39-X

References:

1. Ship Design and Construction, Lamb, T. (Editor), Society of Naval Architects and Marine Engineers, ISBN 0-939773-40-6

SYLLABUS

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- II
04-PAPER: - Shipbuilding Technology			
Periods per week Period of 60 min.	Lecture	4	
	Assignment	1	
	Tutorial	-	
		Hours	Marks
Examination System	Theory Examination	3	100
	Internal Assessment	-	50
	Oral Examination	-	50

Objective: To understand modern ship building techniques including Block Assembly

Detailed Teaching Syllabus

Sr. No.	Details	Hrs.
Module 01	1.1 Introduction to Shipbuilding :- Nature and characteristics of shipbuilding industry. Production structure. Stages in shipbuilding process. Lofting.	6
Module 02	2.1 Shipbuilding process :- Steel, machinery and equipment storage. Steel parts manufacturing – straightening, abrasive cleaning and protective coating, cutting and forming. Various assembly stages. Outfitting and machinery systems and their integration into the ship. Transfer of ship from land to water. Tests, trials and commissioning.	15
Module 03	3.1 Welding Technology:- Welding processes used in shipbuilding. Types of welded joints. Welding defects. Testing of welded joints. Control of welding distortion.	12
Module 04	4.1 Shipyard Layout and Equipment Development of shipyard layouts. Interaction between layout and production flow. Building berths and building docks. Materials handling in ship production. Shipyard equipment.	9
Module 05	5.1 Elements of Shipbuilding Management Shipyard organization. Relation between design and production. Product work breakdown structure. Production planning and control. Quality control and dimensional accuracy. Cost control. Human resource management.	9
Module 06	6.1 Shipbuilding Contracts :- Estimation of costs and delivery periods. Ship specifications. Elements of a shipbuilding contract. Shipbuilding project management.	9

List of Assignments:

1. Report on visits to the shipyard / repairyard / drydock / ship (Once a week)
2. Design of Steel Stockyard of a medium sized shipyard.
3. Layout of Steel parts manufacturing facility.
4. Cost estimation of a ship.

Text Books:

1. Ship Construction, Eyres, D.J., Butterworth-Heinemann, ISBN 0-7506-4887-2.

References:

1. Ship Design and Construction, Lamb, T. (Editor), Society of Naval Architects and Marine Engineers, ISBN 0-939773-40-6.
2. Ship Production, Storch, R.L., Hammon, C.P., Bunch, H.M., Moore, R.C., Society of Naval Architects and Marine Engineers, ISBN 0-87033-461-1.

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- II
05-PAPER: - Marine Auxiliary Machinery			
Periods per week Period of 60 min.	Lecture	4	
	Assignments	2	
	Tutorial	-	
		Hours	Marks
Examination System	Theory Examination	3	100
	Internal Assessment	-	50
	Oral Examination	-	50

Objective: To understand design requirements for installation and operation of machinery and other systems like Electrical, Piping, Ventilation, Cargo handling, etc.

Detailed Teaching Syllabus

Sr. No.	Details	Hrs.
Module 01	1.1 Ship Piping System:- Design and basis of ship piping systems. Types of pumps and their applications. Valves and other fittings. Piping calculations. Preparation of system schematics. Selection of pipe diameter / optimization of pipe diameter through pressure drop analysis. Control and monitoring logic of systems. Piping in tank spaces. Design of sea suction chambers. Tankage calculation, layout of tanks, cofferdams, RU tanks, sullage tanks and fittings. Preparation of P & I drawings and ISOs of systems. Instrumentation – sensors, level indicators, alarms, gauges, control panels remote operation & control.	12
Module 02	2.1 Heating, Ventilation and Air Conditioning :- Types of systems and their characteristics. HVAC equipment. Design of ship HVAC systems. AC ducting design. ATU sizing. Machinery room ventilation. Refrigeration plant.	9
Module 03	3.1 Ship Electrical System :- Power generation and distribution systems. Insulation and protection. Load analysis. Shipboard cabling. Degaussing. Exterior and interior communication. EMI / EMC effect. General lighting. Electrical system layout. Steering gear and stabilizer controls	9
Module 04	4.1 Machinery Compartment Layout :- Layout of main propulsion system. Machinery compartment planning and layout. Allocation of auxiliary equipment and system layout. MCR. Fire Zones.	9
Module 05	5.1 Other Ship Systems :- Cargo handling systems. Anchoring and mooring system.	9
Module 06	6.1 Life Saving, Fire Fighting and Navigation Systems :- Life saving apparatus. Fire fighting apparatus. Navigation lights and sound signals. Bridge equipment and layout. Communication systems	12

List of Assignments:

1. Preparation of a Fire Control Plan of a Cargo Ship of 20,000 GT
2. Preparation of an Accommodation Plan of a Cargo ship of 20,000 GT showing Thermal protection such as A-60 and other bulkheads
3. Preparation of an LSA, L & SS Plan of a cargo ship of about 20000 GT with 25 souls on board.
4. Design of Bilge and Ballast Piping system for a cargo ship of 20,000 GT.

Text Books:

1. Marine Auxiliary Machinery, Mc George H.D., Butterworth- Heinmann
2. Marine Auxiliary Machinery, Smith D W., Newnes, Butterworth
3. General Engineering Knowledge, Mc George H. D., Butterworth Heinmann
4. Practical Marine Electrical Knowledge, Hall, Dennis T., Videotel

References:

1. Materials for Marine Machinery, Frederick S. H. and Chipper H., The Institute of Marine Engineers
2. Marine Engineering Practice, Refrigeration Machinery and Air Conditioning, Arora C. P.

SYLLABUS

COURSE: Advanced Diploma in Naval Architecture And Shipbuilding			Semester- II
06-PAPER: - Project			
Periods per week 1 Period of 60 min.	Lecture	-	
	Assignment	6	
	Tutorial	-	
Examination System		Hours	Marks
	Theory Examination	-	-
	Internal Assessment	-	100
	Oral Examination	-	100

Objective: To familiarize the students with data collection, interpretation and analysis.
To train students for developing a presentation based on the Project undertaken.

It is recommended that students form themselves into groups of minimum 4 and maximum 8 students per group for project work.

Sr. No.	Details	Hrs.
	An Assignment on a specific topic involving design or analysis leading to a dissertation <u>GUIDELINES FOR SUBMISSION OF REPORT OF PROJECT</u> 1. Introduction & Literature Survey 2. Objective 3. Body of Project 4. Feasibility Study 5. Methodology 6. Design / Synthesis / Analysis 7. Fabrication and Details 8. Drawings 9. Test Rigs and Tests 10. Results / Discussion 11. Conclusion 12. Future Work 13. References 14. Appendix – This should contain Drawings, Graphics, Coding used etc.	90

Oral Examination:

Oral examination will be based on the Dissertation. 100 Marks.

Equal weightage (50% Each) will be given to the marks of the Internal and External Examiner.

a)	Presentation	30	Marks
b)	Group Discussion	30	Marks
c)	Interview / Viva voce	40	Marks
	Total	100	Marks

Internal Assessment:

Internal Assessment shall consist of an assignment leading to a dissertation. The Internal Assessment marks shall be jointly given by the Internal and External Examiner with equal weightage (50% each). The distribution of marks for Internal Assessment shall be as follows:

a)	Design and Methodology	25	Marks
b)	Data Collection	25	Marks
c)	Literature Survey	15	Marks
d)	Quality of Project	35	Marks
	Total	100	Marks

The Candidates are required to submit their project report (typed spiral binding or bound black copy) in Duplicate one month prior to the Commencement of Semester - II examinations. One copy will be kept with the college / Institute for future references/guidelines

ANNEX - 1

Equipments (Area / Laboratory wise)

Sr. No.	Particulars / Equipments	Qty.
A	Audio Visual Aids for Class Room	
1	TV Color (Minimum 29" with Trolley)	1
2	DVD / VCD Player	1
3	OHP	1
4	LCD Projector	1
5	Computer/ Laptop with Multimedia Support	1
B	SHIP DESIGN LAB	
6	Server (as per the configuration required by the software – but minimum: Dual core CPU, 4 GB Memory, 750 GB Hard Disk x 2)	1
7	Computers with P4 Processor (configuration as per the requirement of the software but minimum: P4 Thin Client	22
8	LAN Networking – CAT 6	–
9	UPS (As per requirement) Recommended	1
C	Software	
10	Operating System (as per the configuration required by the software – Windows XP or better)	Licensed
11	3-D CADD (Computer Aided Design)	Licensed
12	Ship Conceptual Design Software	Licensed
13	Ship Detailed Design Software	Licensed
D	Others	
14	Various Scale Models of Different types of ships	At least 2 Models
15	Instructional DVDs / VCDs (from IMO, IIT and other sources)	
16	Classification Rules CD and Hardcopy (IRS, DNV, RINA, NKK or other)	

5904 TUITION FEES CALCULATION

FEES FOR THE ONE YEAR ADVANCED DIPLOMA IN NAVAL ARCHITECTURE & SHIPBUILDING

A) Tuition Fees

Naval Architects	Full Time	2 x 60,000 = Rs. 120,000/-
Marine Engineers	Full Time	1 x 70,000 = Rs. 70,000/-
Shipwrights	Part Time	1 x 30,000 = Rs. 30,000/-
Master Mariner	Full Time	1 x 70,000 = Rs. 70,000/-
Marine Electrical Engr	Part Time	1 x 25,000 = Rs. 25,000/-

Total 5 Faculties = Rs. 315,000/- p.m.

$3,15,000 \times 12 \div 60 = \underline{\text{Rs. 63,000/- per student}}$

B) Exam Fees = Rs. 1,000/- per student

C) Laboratory Charges

a) Software License Fees (yearly)

NAPA	Rs. 3,00,000/- (proposed ship design software)
CATTEA	Rs. 2,50,000/- (proposed ship design software)
CADD	Rs. 1,26,000/- (proposed CAD/CAM software)

b) Ship & Shipyard Visit

15 visits x 60 x 450/- per student = Rs. 4,05,000/-
(Transportation, Lunch included. Mumbai Port charges
Rs. 150/- per student as entry.)

c) Hardware charges = Rs. 1,00,000/-

Total (a+b+c) = 11,81,000/- $\div 60 = 19,683/-$

say = Rs. 20,000/- per student

D) Operational & Administrative Cost = Rs. 38,000/- per student

- a) Principal / Director (Yearly Salary = Rs. 9,60,000/-)
- b) Laboratory Assistants (1 x 84000 = 84,000/-)
- c) Other support staff (2 peons x 72000 = 144,000/-)
- d) Placement & Training Officer (Yearly Salary = 1,80,000/-)
(Rs. 15,000/- extra per month to suitably qualified Naval Architect/
Marine Engineer/Master Mariner
faculty who is also working as
Training & Placement Officer)
- e) Administrative & Office staff (1 Recep = 72000/-
(1 Acct = 1,80,000/-)
(1 Admin off = 1,80,000/-)
- f) Electricity, Telephone, Transport
(Electricity = 12 x 10000 = 120,000/-)
(Telephone = 12 x 5000 = 60,000/-)
(Transport = 12 x 5000 = 60,000/-)
- g) Stationery, consumables (12 x 10,000/- = 1,20,000/-)
- h) Regular maintenance (12 x 10,000 = 1,20,000/-)

Total (a to h) = 22,80,000 ÷ 60 = Rs. 38,000/- per student

E) Others (Library, Development, Misc.)

- a) Library (Rs. 5000/- per student)
- b) Development Charges (Rs. 2000/- per student)
- c) Other/Misc. Charges (Rs. 1000/- per student)

Total (a+b+c) = Rs. 8,000/- per student

TOTAL (A + B + C + D + E) = Rs. 1,30,000/- Per student

Proposed Fees for the Course = Rs. 1,30,000/- Per Student

(The proposed fee per student is based on the course being conducted with a full class of 60 students. At 90% full the cost per student will be Rs. 144,400/- and at 80% full the cost will be 162,500/- per student. The course is expected to be running at full capacity)