B. Sc. Nautical Science Syllabus

First Semester

A. Theory							
Sl. No.	Code	Subjects	Contacts periods per week				Credit points
			L	T	P	Total	
1.	BNS-101	English & Communication Skills	3	0	1	4	4
2.	BNS-102	Applied Mathematics Paper – I	4	0	0	4	4
3.	BNS-103	Nautical Physics & Electronics Paper –I	3	0	1	4	4
4.	BNS-104	Principles of Navigation Paper – I	3	0	1	4	4
5.	BNS-105	Ship Operation Technology Paper – I	3	0	1	4	4
6.	BNS-106	Naval Architecture Paper – I	4	0	0	4	4
Total of Theory						**24**	**24**

B. Practical							
Sl. No.	Code	Subjects	Contacts periods per week				Credit points
			L	T	P	Total	
1.	BNS-191	Practical Navigation Paper – I	0	0	3	3	2
Total of Practical						3	2
Total of 1st Semester						27	26

Second Semester

A. Theory							
Sl. No.	Code	Subjects	Contacts periods per week				Credit points
			L	T	P	Total	
1.	BNS-201	Applied Mathematics Paper – II	4	0	0	4	4
2.	BNS-202	Nautical Physics & Electronics Paper –II	3	0	1	4	4
3.	BNS-203	Voyage Planning & Collision Prevention Paper – I	2	0	2	4	4
4.	BNS-204	Cargo Work & Marine Communication Paper – I	3	0	1	4	4
5.	BNS-205	Environmental Science Paper – I	3	0	1	4	4
6.	BNS-206	Marine Engineering & Control System Paper – I	3	0	1	4	4
Total of Theory						**24**	**24**

B. Sc. Nautical Science Syllabus

B. Practical							
Sl. No.	Code	Subjects	Contacts periods per week				Credit points
			L	T	P	Total	
1.	BNS-291	Chart Work Paper – I	0	0	3	3	2
Total of Practical						3	2
Total of 2nd Semester						27	26

Third Semester

A. Theory							
Sl. No.	Code	Subjects	Contacts periods per week				Credit points
			L	T	P	Total	
1.	BNS-301	Applied Mathematics Paper – III	4	0	0	4	4
2.	BNS-302	Nautical Physics & Electronics Paper –III	3	0	1	4	4
3.	BNS-303	Voyage Planning & Collision Prevention Paper – II	2	0	2	4	4
4.	BNS-304	Bridge Procedure & Legal Knowledge	3	0	1	4	4
5.	BNS-305	Environmental Science Paper – II	3	0	1	4	4
6.	BNS-306	Marine Engineering & Control System Paper – II	3	0	1	4	4
Total of Theory						24	24

B. Practical							
Sl. No.	Code	Subjects	Contacts periods per week				Credit points
			L	T	P	Total	
1.	BNS–391	Chart Work Paper – II	0	0	3	3	2
Total of Practical						3	2
Total of 3rd Semester						27	26

Fourth Semester

A. Theory							
Sl. No.	Code	Subjects	Contacts periods per week				Credit points
			L	T	P	Total	
1.	BNS-401	Computer Science	3	0	1	4	4
2.	BNS-402	Applied Mathematics Paper – IV	4	0	0	4	4

3.	BNS-403	Nautical Physics & Electronics Paper – IV	3	0	1	4	4
4.	BNS-404	Principles of Navigation Paper – II	3	0	1	4	4
5.	BNS-405	Ship Operation Technology Paper – II	3	0	1	4	4
6.	BNS-406	Naval Architecture Paper – II	4	0	0	4	4
Total of Theory						**24**	**24**

B. Practical							
Sl. No.	**Code**	**Subjects**	**Contacts periods per week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	BNS-491	Practical Navigation Paper – II	0	0	3	3	2
Total of Practical						3	2
Total of 4th Semester						**27**	**26**

Fifth Semester

A. Theory							
Sl. No.	**Code**	**Subjects**	**Contacts periods per week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	BNS-501	Principles of Navigation Paper – III	4	0	1	5	5
2.	BNS-502	Ship Operation Technology Paper – II	4	0	1	5	5
3.	BNS-503	Naval Architecture Paper – III	5	0	0	5	5
4.	BNS-504	Maritime Law	5	0	0	5	5
5.	BNS-505	Environmental Science Paper – III	4	0	1	5	5
Total of Theory						**25**	**25**

B. Practical							
Sl. No.	**Code**	**Subjects**	**Contacts periods per week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	BNS-591	Marine Communication & GMDSS	0	0	3	3	2
Total of Practical							
Total of 5th Semester						**28**	**27**

Sixth Semester

A. Theory

B. Sc. Nautical Science Syllabus

Sl. No.	Code	Subjects	Contacts periods per week				Credit points
			L	T	P	Total	
1.	BNS-601	Principles of Navigation Paper – IV	4	0	1	5	5
2.	BNS-602	Ship Operation Technology Paper – IV	4	0	1	5	5
3.	BNS-603	Voyage Planning & Collision Prevention Paper – III	3	0	2	5	5
4.	BNS-604	Shipping Management	5	0	0	5	5
5.	BNS-605	Marine Engineering & Control System Paper – III	5	0	0	5	5
Total of Theory						**25**	**25**

B. Practical							
Sl. No.	**Code**	**Subjects**	**Contacts periods per week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	BNS-691	Ship Operation & Safe working practices	0	0	3	3	2
Total of Practical						3	2
Total of 6th Semester						**28**	**27**

WEST BENGAL UNIVERSITY OF TECHNOLOGY

(KOLKATA)

B. Sc. Nautical Science Syllabus

SYLLABUS

FOR

FIRST SEMESTER B. SC. (NAUTICAL SCIENCE)

EFFECTIVE FROM - 2005-2006

FIRST SEMESTER

ENGLISH & COMMUNICATION SKILLS

Course Code: BNS - 101

Marks:100

THEORY

1. **Comprehension**

   a) Study of the prescribed course book for seen comprehension.
   b) Reading and comprehension of unseen passages of modern Prose.

2. **Written Communication**

   a) Formal and ordinary letters, formal invitations, letters to friends and relatives.
   b) Official and semi-official letters. Application for appointment. Commercial letters, Letter to influence public opinion.
   c) Notices, agenda & minutes writing.
   d) Project writing, forecasting dangers, seminar reporting.
   e) Writing factual reports, accidents and maintaining a diary and a log book.
   f) Summarizing/ abstracting the main ideas of an unseen passage, given a working outline.
   g) Stress marking.
   h) Transformation of sentences, narration, voice change.

i) Synonyms, Antonyms, Substitution of word for phrase or clause.

3. **Skills of oral communication**

a) Speech training: Elocution, debating & extempore speech.

b) Group discussions & interviews.

c) Delivery of welcome address.

d) Sea Speak.

PRACTICAL

1. Notice of meeting, agenda & minutes writing.
2. Writing factual reports, maintaining a diary/log book
3. All items under skills of oral communication, i.e. item 3 under course content.
4. Stress marking.

COURSE BOOKS:

1. Communication Skills (Book 1) - S. R. Inthira & V. Saraswati
2. Communication Skills workbook - S. R. Inthira & V. Saraswati
3. Spoken English for Indian - R. K. Bansal & B. Harrison

BOOKS RECOMMENDED FOR REFERENCE :

1. English language Books 1 & 2 - L. A. Hill, C. J. Daswani & C. T. Daswani (Oxford University Press 1975)
2. Writing Communication - Freeman & Sarah
3. Note Marking & Composition Exercises 1979 - ELT Cell, Bombay University
4. Business Correspondence & Report Writing - R. C. Sharma & Krishnamohan
5. Academic Skills - CIEFL, Hyderabad
6. Academic Skills Workbook - CIEFL, Hyderabad
7. Supplementary Reader - CIEFL, Hyderabad
8. Sea Speak Manual - International Maritime Organisation

APPLIED MATHEMATICS – PAPER – I

Course Code: BNS - 102

Marks:100

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Complex Variables** Definition, Cartesian, Polar & exponential form. De-Moivre's Theorem. Power & Roots of Exponential and Trigonometric Functions. Hyperbolic & Logarithmic Functions. Inverse Hyperbolic & Inverse Trigonometric Functions. Separation into real and imaginary parts of all types of functions.		

02.	**Vector Algebra and Calculus** Scalar and Vector Triple Products. Differentiation of a vector function of a single scalar variable. Derivative of a unit vector, application to curves in space, principal triad, Sennet-Frenet form.		
03.	**Differential Calculus** Successive differentiation. Standard form to find the nth derivative. Leibnitz's theorem, Rolle's theorem (with proof), Lagrange's and Cauchy's mean value theorem (with proof), Taylor's theorem, Taylor's and Maclaurin's series (without proof). Indeterminate forms, L'Hospital's rule, Expansion of function in power series (all types), Partial derivatives of first and higher orders. Total differential, Concept of commutativity of partial derivatives (without proof). Euler's theorem on homogeneous functions. Deduction from Euler theorems. Errors & approximations. Maxima & minima of the functions of two variables.		
04.	**Vector Analysis** Line integral, Green's theorem for the plane, properties of line integrals, line integrals in space and their properties, application to work and to the flow of liquid, scalar and vector fields, conservative fields, potentials, gradient, divergence and curl. Divergence theorem, Stoke's theorem, expressions for gradient, divergence and curl in orthogonal curvilinear coordinates, Gauss theorem, equation of heat flow, equations of hydrodynamics.		
05.	**Differential Equations** a) Exact differential equations and those, which can be made exact by use of integrating factors by inspection. (i) Linear Equations and reducible to linear (Bernoulli) equations, (ii) Method of substitution to reduce the equation to one of the above forms. b) Linear Differential Equations of the nth order with constant coefficients. Complimentary function and Particular integral when the function of the independent variable on R.H.S. is eax, xn, eax V(x), Sin (ax + b), Cos (ax + b) Cauchy's Linear equation (homogenous). Legendre's Linear equation. Variation of parameters and method of undetermine coefficients. c) Elementary applications of above differential equations in solving engineering problems such as Electrical Engineering, Mechanical Engineering .		

BOOKS RECOMMENDED FOR REFERENCE

1. Elements of Applied Mathematics – Vol: I - Wartikar P.N. & Wartikar J.N.
2. Text book of Applied Mathematics – Vol: II - Wartikar P.N. & Wartikar J.N.
3. Vector Algebra - Shanti Narayan
4. Vector Calculus - Shanti Narayan
5. Differential Calculus - Shanti Narayan
6. Engineering Mathematics - Bali Saxena Iyengar
7. Plane Trigonometry - Loney S.L.
8. Higher Engineering Mathematics - Dr. Grewal B.S.

9. Differential Equations - Raisinghania
10. Engineering Mathematics - Bhatia M.L.
11. Engineering Mathematics - Baphana R.M.
12. Vector Methods and Vector Calculus - Vaishista
13. Differential equations - Murray P.A.
14. Differential Calculus - Das & Mukherjee
15. Integral Calculus - Das & Mukherjee

NAUTICAL PHYSICS AND ELECTRONICS – PAPER I

Course Code: BNS - 103

Marks:100

THEORY

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Mechanics** Relative Velocity and its application to Radar Plotting, boat sailing etc. Review of Newton's Law of motion, Projectiles. Circular motion, Centripetal and Centrifugal forces. Law of Gravitation, Satellites and their uses in communication, weather forecasting, etc. Work, Power and Energy, Potential and Kinetic energy. Conservation of energy, Conservation of linear momentum, Impulse, collision – direct and oblique impact. Centre of Mass and Centre of Gravity, Effect of movement of masses, Rotational Motion, Torque, Angular Momentum, Conservation of angular momentum, Concept of Gyroscope, Governors, Machines, Mechanical Advantage, velocity ratio, Efficiency, Effect of friction, Pulley systems – Block and Tackle, Differential pulley. **Hydrostatics** Archimedes Principle, up thrust, Buoyancy, Pressure at a depth, Floating objects – Ships, Submarines, Floating Dock, Iceberg, Balloon, Hydrometer, Plimsoll line. Atmospheric Pressure, Barometer, Hydrodynamics: - Streamlines, Turbulence Bernoulli's Equation: - Stability and spin, Aerofoil, lift, rotating cylinder ship. **Surface Tension: -** Capillarity, Angle of contact, Excess Pressure inside a bubble, Air bubbles in an oil tank. **Elasticity: -** Modulus of elasticity, Hooke's Law, Cantilever, Bending of Beams, Shearing force, Rigidity **Oscillations: -** S.H.M. and its features, Typical examples – A Helical spring, a pendulum, Damped & undamped oscillations (vibrations), Resonance. **Waves: -** Longitudinal and Transverse Waves. A travelling simple harmonic wave & its features.		
02.	**Sound** Velocity of sound, Effect of pressure, temperature and humidity on velocity of		

	sound, Pitch, Quality & Loudness, The Decibel. Doppler effect. Interference of two travelling Waves – Beats, Phase comparison – use in Decca and Loran. Echo, Principle of Radar, Echo sounder, Refraction of sound waves, Effect of wind & Temperature.		
03.	**Heat and Thermodynamics** Hygrometry, Relative and absolute humidity. Vapour pressure, S.V.P., Dew Point, Effect on weather-Frost, Mist, Haze Cloud Formations, Rain, Snow and Hail. Transfer of Heat : Conduction, Convection and Radiation. Expansion of solids, liquids and gases and their effect on liquid crgoes. Equation of state for gases, isothermal and adiabatic processes. First law of Thermodynamics, Second Law of Thermodynamics – Carnot cycle. The Heat engine and refrigerator, Concept of Entropy.		
04.	**Light** Propagation of light, Shadows, Eclipses, Reflection of light at plane and curved surfaces, Rotation of a plane mirror. The Sextant. Refraction. Total internal reflection. Mirages. Optical fibre, Propagation of radio waves, refraction through a prism, the azimuth mirror, Periscope. Lenses, Image formation, Telescope, prism Binocular. Diffraction due to a single slit and a circular aperture, Limit of resolution, Interference – Coherent beams, Lasers.		

PRACTICAL

a) Demonstration of block and tackle arrangements b) A single cantilever (loaded at one end). Determination of Y c) Moment of Inertia of Flywheel and Frictional Torque d) Velocity of sound in air (using a CRO) e) Use of CRO to study the characteristics of an audio oscillator (Frequency, Period, Amplitude). f) Measurement of the velocity of ultrasonic wave in liquid by use of ultrasonic interferometer. g) Demonstration of a Weston Differential Pulley h) Surface tension of liquid by capillary rise method. i) Study of Laser: Interference and diffraction due to a single and double slit. j) Stefan's Law of radiation using a filament lamp k) Thermistor as a Thermometer. **NOTE: A minimum of 8 experiments are expected to be performed**		

BOOKS RECOMMENDED FOR REFERENCE

1. Applied Physics - J.H. Clough - Smith
2. Fundamental of Physics - M.Nelkon
3. Principles of Physics - Fredrick J. Bueche

ADDITIONAL REFERENCE

1. Physics: Classical & Modern - Gettys , Keller , Skove

2. University Physics - Young , Sears and Zemansky
3. Sound - Khanna and Bedi
4. Heat & Thermodynamics - Brijlal & Subramaniam
5. Heat & Thermodynamics - Zemansky

PRINCIPLES OF NAVIGATION – PAPER I

Course Code: BNS - 104

Marks:100

THEORY

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Principles of Navigation** a) The shape of the earth, Poles, Equator, Great circles, Small circles, Parallels of latitude, D'Lat, Meridians, Prime meridian, Longitude, D'long, Position by latitude & longitude. b) Measurement of distance : Nautical, Geographical and Statute mile. Knot, Effect of polar compression on nautical mile. c) Compass Points. True and Magnetic north, Magnetic variation and changes in its annual value, compass course to true course and vice-versa. d) Departure. Relationship between Departure and D'long. Parallel sailing. e) Rhumb Line. Mean latitude. Plane sailing. Relationship between departure, d'lat, course and distance. Middle Latitude. f) Principal of Mercator projection : Mercator chart, Natural Scale, Meridional parts; DMP Latitude and longitude scales and conversion of one to the other; Mercator sailing. Relationship between Course, D'long and DMP. g) Principle of Gnomonic projection Gnomonic chart h) Dead Reckoning position (DR), Estimated position (EP) & Observed position (Fix). Set and drift of current. Leeway. i) Spherical triangle. Great circle sailing initial course, final course, distance and vertex. j) Solar System : Rotation and Revolution Equinoxes and solstices. Cause of seasons and unequal length of day and night. k) The principle of the Sextant and the Azimuth Mirror.		
02.	a) Practical problems on parallel sailing using formulae b) Practical problems on plane sailing using formulae c) Practical Problems on Mercator sailing using formulae d) The use of Traverse Tables to obtain the position of the ship at any time, given compass course, variation, deviation and the run recorded by the log or estimated speed or engine allowing for the effects of wind and current, if any, Day's work. e) To find initial course, final course and distance between two positions on		

	the earth's surface by Great Circle Sailing. To calculate the position of the vertex and intermediate points on the Great Circle track.		

BOOKS RECOMMENDED FOR REFERENCE

1. Practical Navigation - Capt. H. Subramaniam
2. Principles of Navigation - Capt. P.M. Sharma
3. Principles of Navigation - Capt. T.K. Joseph and Capt. S.S.S. Rewari
4. Admiralty Manual of Navigation Vol:I and Vol:II - HMSO
5. Navigation - A. Frost
6. Nicholl's Concise Guide Vol:I and Vol:II - Brown, Son and Ferguson Ltd.

SHIP OPERATION TECHNOLOGY – PAPER I

Course Code: BNS - 105

Marks:100

THEOPΨ

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**General** Names of various parts of ship. Names and timings of watches. Types of merchant navy vessels. Sea terms, Look-out, Compass points. Safety wearing apparel – Safety goggles, helmet, safety shoes. Removing rust by chipping hammers. Preparing a surface for painting. Paint brushes. Painting defects and their prevention. Cleaning of wooden decks. Cleaning and polishing of brass and copper.		
02.	**Ropes and Wires** Types of material used, natural fibres, synthetic fibres. Types of lay of ropes and their advantages. Plaited ropes. Characteristic of different types of fibre ropes. Comparison of strength and elasticity of different ropes. Care and maintenance of fibre ropes. Damage caused by surging. Meaning of Marline, spusyam, Oakum, tared hemp, 3 ply and 5 ply twines, halliards, loglines, leadlines. Grades of steel used for making wire ropes. Construction of wire ropes. Advantage of a fibre heart. Factors determining flexibility. Meaning of 6/12, 6/24, 6/37 etc. Plaited wire rope. Plastic covered wire rope. Non-rotating wire rope. Care and maintenance of wire ropes. Measuring sizes of ropes, wires and chains. Breaking strength and safe working load of ropes, wires and chains. To calculate the size of rope or wire required for lifting a weight with a tackle.		

03.	**Life Saving Appliances** Classification of ships for Life Saving Appliances. LSA requirements for cargo ships. Life Boat : Description of lifeboat. Construction and parts of lifeboat. Buoyancy tanks. Means of propulsion. Different classes of lifeboats used. Motor lifeboats, totally enclosed lifeboats, partially enclosed life boats. Determining the carrying capacity of a lifeboat. Equipment, rations and distress signals. Types of boat davits and their method of operation. Liferaft :- Inflatable and rigid. Construction and parts of liferaft. Fiferaft equipment, ration and distress signals. Repairing leaks and punctures. Getting into a liferaft. Inflatable chute. Life Buoy :- Description of a life jacket. Buoyant material used. The correct method of putting on a life jacket and jumping into water. Line throwing appliances : Description and use of the line throwing appliance. Safety, care and maintenance of life saving appliances.		
04.	**Fire Fighting Appliances** Fire hydrants and hoses. Types of connections. International shore connection. Types of nozzles. Description of portable fore extinguishers, various types and their suitability for different types of fires. Operation and refilling of fire extinguishers. Principle of fire extinguishing used each type. Safety devices : Fireman's outfit, Smoke helmet and Self Contained Breathing Apparatus. Safety lamps and their arrangement for prevention of sparks. Fire axe. Asbestos suit. Fixed smothering systems : Brief description of steam smothering system, carbon dioxide smothering system, Insert gas system, Flue gas system, Halon system, Foam smothering system for liquid fires, High expansion foam system. Safety, care and maintenance of all fire fighting appliances.		
05.	**Deck Appliances** Description of the handlead line. Procedure for taking a cast. Different types of logs. Patent log, impeller log, electromagnetic log, pilot log. Principles of their operation. The electric telegraph, description and its operation. Telemotor steering gear. The hydraulic transmitter, Telemotor receive, transmission of steering wheel signals to steering engine. Pressure equalizing sytem. Fluid used. Cross head and floating link connection. Principle of 'Hunting Gear'. Electric steering gear. The wheatstone principle of transmission of steering wheel signals to steering engine. Interswitching of follow-up and Non-follow-up steering systems.		

PRACTICAL

01.	a) To make and understand the use of various bends and hitches : - Mousing hooks and shackles. Breaking flags. b) To apply rope and chain stoppers. To make various types of whippings. c) To perform various splices on natural and synthetic fibre rope d) To perform various spices on wire ropes e) Worming, parceling and serving of hawsers. Throwing a heaving line. f) Heaving the lead and calling out soundings. Slinging a stage/		

	g) Precautions when using stages. Oiling wire ropes in situ by use of Bosun's chair. Safety precautions. h) Seizings : Flat, Round, Racking. Parbuckling, Helm orders. Steering practice. i) Cleaning of wooden decks – Deck washing compounds j) Cleaning and polishing of brass and copper. k) Coiling ropes. Cutting wire ropes. Opening a new coil l) To make and understand the uses of the knots used on board ships for various purposes. m) Taking soundings of tanks and bilges. Measuring ullages. n) Taking freeboard and drafts o) Removing rust by chipping hammers. Preparing a surface for painting. Brush painting, spray painting. p) Changing boat falls q) Streaming and hauling in a patent log. r) Operating windlass and winches s) Changing over from main steering to emergency steering system t) Swinging out and lowering a lifeboat from luffing and gravity davits. Use of Tricing pedants. u) Handling of lifeboat under oars – coming alongside, getting away and picking up a man overboard. v) Handling of lifeboat under sail: Types and parts of sails. Setting sail. Sailing a lifeboat. w) Handling of boats in rough weather: Heaving to. Use of sea anchor and steering oar. Rescuing a man overboard. x) Starting the engine of a motor lifeboat. Man overboard drill. y) Tuning short around, towing other crafts. z) Hoisting a lifeboat on davits. Checking the working of cut-off switches. aa) Launching of liferafts. Inflating liferafts. Method of righting a liferaft which has inflated upside down, Boarding a liferaft Jumping into the water. Getting away from ship. Artificial respiration. bb) Use of lifeboat WT: Installation of aerial. Tuning the transmitter. Transmitting Automatic Distress signal. Transmitting manually. Receiving. Listening times for distress calls. cc) Donning a smoke helmet and self contained breathing apparatus. dd) Action on hearing the emergency signal. ee) Charging of various types of fire extinguishers ff) Canvass sewing. Changing the canvess covering of a lifebuoy		

BOOKS RECOMMENDED FOR REFERENCE

1. Theory and Practice of Seamanship - G. Danton
2. Seamanship Notes - Kemp and Young
3. Nicholls Seamanship - Brown, Son and Ferguson Ltd.
4. Life Boat & Life Raft - Capt. S. K. Puri
5. Survival at Sea - Wright C. H.

6. Life Saving appliances Rules - Govt. of India.
7. Fire Fighting appliances Rules - Govt. of India.

NAVAL ARCHITECHTURE – PAPER I

Course Code: BNS - 106

Marks:100

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Ship Construction** Introduction – Development of ocean-going Merchant Ships. Modern merchant ships. Types of Ships :- Types of ships based on nature of cargo. Passenger Liners, Ferries. Specialized carriers for General Cargo, Bulk, Oil (Crude Oil and Products) OBO's, Container, RORO, Lash LPG, LNG, Cattle, Cars etc. Special features of above types of ships. Definitions & Meanings :- LOA, LBP, EB, MB, Depth, Draft, Freeboard, Camber, Sheer, Rake, Rise of floor, etc. Principal Parts of a Ship :- Bow, Stern, Shell plating, Double Bottom Tanks, Cargo Holds, Tween Decks, Deep Tanks, Fore-peal and After Peak store rooms and tanks. Plate Keels and Duct Keels. Forecastle deck, Quarter Deck. Main/ Weather decks, Hatch covers, Cargo Gear, anchoring and mooring equipment etc. Machinery Spaces :- Engine Room – Engine Casing, subdivisions of Engine Room, Steering Gear, Pump rooms, Masthouses, Work-shops etc. Superstructure :- Wheel House, accommodation spaces, cabins, galley, pantry, dining saloons, recreation rooms, various stores and lockers, cold storage spaces etc. **General Layout of Ships** : General Cargo Ship, Bulk Carrier, Oil Tanker and Container Ship. Simple sketches of the same. **Principles of Design** : Common principles governing design and construction of various types of steel ships with respect to : a) Longitudinal, transverse and vertical strength b) Continuity of strength c) Strength – under static and dynamic conditions d) Stability e) Water-tightness f) Conformity with statutory requirements **Steel for Ship Construction –** Types of steel used in ship construction. Steel plates and their treatment. Rolled sections – various shapes and standard sizes. Castings and forgings and their use in construction. Testing of materials – various tests at production and building stages. **Riveting and Welding: -** Riveting as a joining process. Welding – its pre-dominant use in ship construction. Advantages of welding over riveting ship		

	construction. General ideas if Electric Arc welding – equipment, coated electrodes, methods used, etc. Gas welding and Gas cutting. Precautions while welding.		
02.	**Ship Stability** Laws of flotation. Buoyancy, Reserve buoyancy. Displacement, Deadweigt. Change of draft due to change of density TPC, FWA, DWA. The center of gravity of a ship and factors affecting the same. The center of buoyancy and factors affecting the same. Calculations involving KG and KB of a ship. The meaning of the terms Block co-efficient, Water-plane-coefficient, Mid-ship Coefficient, Prismatic Coefficient and relationship between them. Use of displacement and TPC curves and scales to determine weights of cargo or ballast from draughts or freeboards. Metacentric height, Righting lever, Righting Moment, Stable, Unstable and Neutral equilibrium. Free Surface Effect. Stiff and Tender ships. Difference between heel and list. Use of hydrostatic tables and curves as supplied to ships Calculations based on the foregoing topics.		

BOOKS RECOMMENDED FOR REFERENCE

1. Ship Construction notes - Kemp and Young
2. Ship Construction for Engineers - Reid
3. Ship Construction - Pursey
4. Ship Stability - Capt. H. Subramaniam
5. Problems on M.V. Hindship - Capt. T.K. Joseph and Capt. S.S.S. Rewari

PRACTICAL NAVIGATION

Course Code: BNS – 191

Max. Marks: 100

a) Practical problems on parallel sailing using formulae

b) Practical problems on plane sailing using formulae

c) Practical Problems on Mercator sailing using formulae

d) The use of Traverse Tables to obtain the position of the ship at any time, given compass course, variation, deviation and the run recorded by the log or estimated speed or engine allowing for the effects of wind and current, if any, Day's work.

e) To find initial course final course and distance between two positions on the earth's surface by Great Circle Sailing. To calculate the position of the vertex and intermediate points on the Great Circle track.

f) The chronometer. Checking chronometer error by radio signals. Finding U.T. and correct date.

g) The micrometer Sextant. Arc of excess. Error of perpendicularity. Side error. Index error on the arc and off the arc. Collimation error. Taking vertical and horizontal angles. Position fixing by bearing and vertical sextant angle of a light house. Position fixing by horizontal angles between three or more points.

h) Recognition of important stars with reference to stellar constellations

i) The use of Azimuth mirror and pelorns, procedures for checking accuracy of azimuth mirrors.

j) The use and care of magnetic compasses Precautions to be observed while taking compass bearings. Practical limitations of the magnetic compasses.

WEST BENGAL UNIVERSITY OF TECHNOLOGY

(KOLKATA)

SYLLABUS

FOR

SECOND SEMESTER B. SC. (NAUTICAL SCIENCE)

EFFECTIVE FROM - 2005-2006

B. Sc. Nautical Science Syllabus

SECOND SEMESTER

APPLIED MATHEMATICS – PAPER – II

Course Code: BNS - 201

Marks:100

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Integral Calculus** Rectification of plane curves, Double & Triple integrals, their geometrical interpretation and evaluation, Evaluation of double integrals by change of order and change to polar form. applications of double & triple integrals to areas and volumes, Centre of Mass, Moment of Inertia, Applications of integration to the evaluation of first and second moments of areas and volumes.		
02.	**Beta & Gama Functions** i. Beta & Gama functions & their properties, relation between Beta & Gama functions. ii. Error functions Differentiation under integral sign		
03.	**Infinite Series and Fourier Series** Convergence of infinite series, uniform convergence, properties of uniformly convergent series, power series and their properties, expansion of a function as power series, Exponential and logarithmic series, definition of Trigonometric and Fourier series, Fourier coefficients, Dirichlet's conditions , statement of Dirichlet's theorem, expansion of functions in Fourier Series, Even and Odd functions, half range Fourier series. Complex form of Fourier series, Differentiation and Integration of Fourier Series, Fourier series with respect to a set of orthogonal functions over (a,b). [Fourier series over $(-\pi,\pi)$, $(0, 2\pi)$ and for arbitrary range (a, a+2L) must be treated.		
04.	**Spherical Trigonometry** Properties of a spherical triangle and oblique spherical triangle. Cosine formula, Haversine formula, Sine formula and four part formula and their application to Navigation problems. Polar triangle and application of their properties. Right angle and quadrantal triangles. Napier's Rules and their application to Navigational problems. Area of a spherical triangle. Inequalities, Derivation of formula by supplemental theorem, 'Half angle' formula, 'Half side' formula, Identities. Delambre's Analogies. Napier's Analogies, Lagendre's theorem.		
05.	**Simpson's Rules** Derivation of Simpson's first, second & five-eighth rules & their ues in the computation of areas volumes & centriods.		

BOOKS RECOMMENDED FOR REFERENCE

16. Higher Mathematics for Engineers and Physicists - Sokolsikoff I.S. & Sokolsikoff E.S.
17. Advanced Calculus - Wilfred Kaplan
18. Spherical Trigonometry - Capt. H. Subramaniam

19. An introduction to Spherical Trigonometry - Clough-Smith J. H.
20. Ship Stability for Masters & Mates - Derret. D. R
21. Higher Engineering Mathematics - Dr. Grewal B.S.
22. Integral Calculus - Shanti Narayan
23. Text Book of Applied Mathematics - Wartikar. P. N. & Wartikar J. N.

NAUTICAL PHYSICS AND ELECTRONICS – PAPER II

Course Code: BNS - 202

Marks:100

THEORY

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Magnetism** Earth as a magnet, magnetic elements and their variation, Magnetism of the ship and its components, Effect of motion of the ship and latitude on the compass. Compasses – wet and dry card compasses.		
02.	**Electricity** AC and DC voltages, dangerous levels, precautions. Static electricity and its hazards, Electrostatic charging of petroleum, precautions during loading and unloading. DC circuits, insulation, earthing. Work, energy, power I a circuit. Electrical appliances on board ship. Heating effect of electric current – heaters, fuses arc lamps, welding. Chemical effect – corrosion and electrolysis. Cathodic protection. Cells, accumulators, batteries. Care and rating of accumulators. Magnetic Effect : Magnetic field due to a stationary coil, Electromagnet, Circular lifting magnet, Review of electro magnetic induction. Faraday-Lenz's Law, transformer. DC motors – series and shunt wound. The AC generator, AC sinusoidal voltage and current. Average and effective values, AC circuits composed of R, L and C (series and parallel), reactance, impedance, series and parallel resonance, power factor. Three phase AC. The induction motor.		
03.	**Electronics** P and n type semiconductors, P-n junction diodes – their characteristic, half-wave, full wave and bridge rectifiers, voltage regulation. Ripple, Capacitor filter, Zener Diode, its uses as a voltage regulator. 3-Terminal IC voltage regulator. Thermistors :-Use in temperature control. Transistors :- pnp, npn, 3 modes of operation, current gains α and β . photoelectric effect, opto-electronic devises – LDR, LED, 7-Segment displays, photo diode, photo transistor, electro-optic modulator.		
04.	**Modern Physics** Radioactivity, emissions from natural radioactive nuclei, radioactive series. Detection of radiation, GM counter, radiation units. Radiation damage, Nuclear fission and Fusion, Nuclear Reactors. Nuclear Powered Ships. Nuclear hazards and precautions.		

a) Series L-R and C-R AC circuits, Determination of impedance, L & C b) Magnetic elements of the earth, use of a Dip circle c) Use of multimeter (analog and digital) to determine resistance. Comparison with color code value. d) Use of multimeter (analog and digital) for testing of diodes and transistors e) Ripple to be obtained on CRO. f) LED, LDR characteristics g) Forward and Reverse characteristic of Rectifier Diode and a Zener Diode. h) CE characteristics of an NPN transistor, Determination of α and β. i) Half-wave Rectifier – Voltage regulation and ripple. Effect of a capacitor filter. j) Bridge rectifier – Voltage regulation and ripple. Effect of a capacitor filter. k) Study of an IC voltage Regulation, Voltage Regulation and Ripple l) Use of Digital multimeter and DPMs is preferred for measurement of voltage and current **NOTE: A minimum of 8 experiments are expected to be performed**		

BOOKS RECOMMENDED FOR REFERENCE

1. Electronic Principles - Malvno
2. Electronic Devices ad Circuit Theory - Boylestad and Nashelsky

ADDITIONAL REFERENCE

1. Physics – Classical and Modern - Gettys, Keller, Skove
2. University Physics - Young, Sears and Zemansky
3. Electricity and Magnetism - Brijlal and Subramaniam

1. Physics Part II - Halliday and Resnick
2. Modern Physics - B.L. Theraja
3. Basic Electronics - B.L. Theraja

BOOKS FOR PRACTICALS FOR PAPERS I AND II

1. Advanced Level Practical Physics - M. Nelkon
2. Electronics – A test Lab Manual - Zabar

VOYAGE PLANNING & COLLISION PREVENTION – PAPER I

Course Code: BNS - 203

B. Sc. Nautical Science Syllabus

Marks:100

THEOPΨ

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Voyage Planning** The nautical chart, Nautical Scale, types of projections, Title of Chart, Number of Chart, Date of Publication. Deciphering the symbols and abbreviations used on a nautical chart. Units of Soundings used. How to read latitude and longitude. The use of parallel rulers to lay down or read courses and bearings. The Compass Rose. The distance scale. Use of dividers to measure distances. Reason for using the nearest latitude scale for measuring distance. Correction from Notices to Mariners. To find the date the Chart was last brought up to date. Small and large Correction. Degree of reliability of information shown on the chart. Types of charts – Ocean charts, coastal charts, harbour plans, Decca charts, Consol charts, Loran charts, Routeing charts. The use of the Admiralty Catalogue to identify the charts required for voyage. Meaning of Chart Datum. Reference point used for heights. Nature of bottom. Depth Contours. Information regarding lights. Heights, colour and characteristics of lights. Use of leading lights for safe navigation in harbour. Horizontal sectors of lights and their use by navigators in keeping clear of submerged dangers to navigation. Use of sectors in laying courses. Use of clearing marks and horizontal and vertical danger angles. Sailing round an arc. True, Magnetic and Compass North. Variation. Annual rate of change of variation. How to obtain variation from date given on the Compass Rose. Deviation of the compass. The Deviation Card True, Magnetic and Compass course. Conversion of one to another. The compass error for the ship's head. True, Magnetic and compass bearings. Conversion of one to another, Gyro Error, High and Low, Conversion of Gyro courses to True course and Vice-Versa. The effect of current on course made good. Set and drift. The effect of wind on course made good. Leeway. The Dead Reckoning Position, Estimated Position and Observed Position.		
02.	**COLLISION PREVENTION** International Regulations for preventing collisions at sea. Application. Exceptations for local rules or harbours etc. Exceptions for special class of ships. Responsibility for the consequence of neglect of rules. Definitions of term 'Vessel', 'Power driven vessel', 'sailing vessel', 'fishing vessel', 'seaplanes', 'Underway', restricted visibility', Steering and sailing rules : **A. Conduct of vessels in any condition of visibility** : Maintenance of proper look out. Maintenance of safe speed. Factors to be considered for determining safe speed. Determination of risk of collision with another vessels. Use of rader in determining risk of collision. Use of visual bearings. Types of actions to be taken to avoid collision or close quarter situation. Conduct of vessels in narrow channels and when approaching blind bends. Conduct of vessel in traffic separation schemes of International Maritime Organisation. **B.Conduct of Vessels in sight of one another**: Responsibility to keep out of way when two sailing vessels are to collision course. Responsibility to keep out		

	way when one vessel is overtaking another vessel of any type. Action to be taken by a vessel when meeting another vessel head on. Responsibility to keep out of way when two vessels are crossing each other. Action to avoid collision. Duty of the vessel which has the right of way. Action to be taken by such vessel required to keep out of way is not taking avoiding action. Right of way between a normal power driven vessel, a vessel not under command, a vessel restricted in her ability to manoeuvre, a vessel engaged in fishing, a sailing vessel and a vessel constrained by her draft **C.Conduct of Vessels in restricted visibility :** Applicability. Determination of risk of collision when another vessel is detected by radar alone. Actions to be taken/ avoided to prevent close quarter situation with a vessel detected on radar alone. Action to be taken when fog signal of another vessel is heard but vessel is not seen though it may have been detected by radar.		

PRACTICAL

COLLISION PREVENTION : Syllabus same as theory

VOYAGE PLANNING

a) To find compass error by transit bearings. b) To find the position of a point on the chart by its latitude and longitude c) To find the position of a point on the chart by its bearing and distance from a navigational mark d) To plot ship's position given the compass bearings of two or more shore objects. The Cocked hat' and the reasons for its formation. e) To plot ship's position using three shore objects by horizontal sextant angles (given Horizontal sextant angle less than 90, equal to 90, or greater than 90). f) To plot a position line obtained by an astronomical observation g) To find compass course between two positions on the chart. h) To find the course and distance made good, given course steered, set and drift of current and leeway. i) To find the course and speed made good and the set and drift, given the course steered, speed, duration and the initial and final observed positions. j) To find the course from a given position so as to pass a lighthouse at a given position so as to pass a lighthouse at a given distance when abeam. k) To plot ship's position, given the rising or dipping bearing of a light. Caution during abnormal refraction. l) To plot ship's position, given vertical sextant angles and bearing of light house. m) To plot a position lines obtained by Radio Aids to navigation n) To find compass course to seer between two positions on the chart so as to counteract the given and drift of current and given leeway		

BOOKS RECOMMENDED FOR REFERENCE

1. Chart Work for Mariners - Capt. S.K. Puri
2. Voyage Planning and Chart Work - Capt. M.V. Naik and Capt. Varty

3. Nicholl's Concise Guide Vol: I - Brown, Son and Ferguson
4. Marine Chart Work - D.A. Moore
5. Rules for the prevention of collision at sea - Bhandarkar Publication
6. Rule of the Road Manual - Capt. S.K. Puri
7. International Lights, Shapes and Sound Signals - D.A. Moore

CARGO WORK & MARINE COMMUNICATION – PAPER I

Course Code: BNS - 204

Marks:100

THEOPΨ

SECTION A: CARGO WORK

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**General :-** Stress and strain. Elastic limit, Yield Point, Breaking strength, Proof Load, Factor of Safety, Safe working load. Annealing and normalizing of cargo gear.		
02.	**Cargo Gear : -** Blocks – Parts of a block, different types of block, non-toppling and snatch blocks. External binding. Internal binding, strapped. Markings on a block. Size of a block and sheave, size of rope to be used in a block. Relationship between diameter of sheave and diameter of rope. **Tackles –** Names of parts of a tackle, using a tackle to advantages or disadvantage. Mechanical advantage, velocity ratio or 'Power gained', efficiency of a tackle, relationship between pull on the hauling part and load. Types of tackles/ purchases used on ships. **Shackles –** Various types. Markings on cargo shackles Cargo hooks – Various types. Markings on cargo hooks. **Ropes –** Care of ropes and wires used for cargo gear. **Derrick rigs –** The Union purchase. Setting up of a union purchase. Importance of preventer guys. Maximum load to be used for angle between runners. Swinging derrick with powered guys. Putting winches in double gear. The Yo-Yo gear. Working of ship's craners. Hoisting, lowering and securing a derrick. **Stresses –** Calculating the stresses in various parts of a derrick rig. Calculating the tension on ropes and wires of a purchase and finding the correct size to be used. **Slings –** Types of slings used for lifting cargo of different types. Accident prevention when working cargo. **Overhauling blocks** – Care and maintenance. Reeving a three fold purchases. **Hatch-covers –** Types of hatches. Opening and closing of McGregor and Hydraulic hatchcovers. Closing arrangements. Battening down a hatch.		
03.	**Transportation of Goods by Sea:** Categories of cargo, bulk solid, bulk liquid, chemicals in bulk, gas, dangerous goods, general cargo, heavy lifts. Methods of		

04.	carrying cargoes, tanks, containers, holds, portable tanks abroad ship, ro-ro, refrigerated containers and holds. **Cargo Care:** Importance of cargo care to economical operation of ship. Care of cargo on board ship. Securing cargo by using Bulldog grips and bottle screws. Securing by chains and tensioners. Container lashing and securing. Fire prevention, interaction, temperature variations leading to sweat damage, seawater damage, ventilation to avoid hazardous gas accumulations, dunnage, separations, bulkheads, shifting boards.		

SECTION B: MARINE COMMUNICATION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Meaning of bunting, halyard, at the dip, close up, half mast, hoist, fly, tackline Courtesy flag, ship's numbers, jack flag, quarantine flag, pilot flag, Blue Peter. Location on a ship of Jack staff. Ensign staff, Gaff, Triatic stay, Foremast Yardarm, Main mast head. What flags are hoisted from these part of ship and when Types of ensigns. Penalty for not using or wrongly using an ensign.		

PRACTICAL

a) To send and receive signals by morse code visually. b) Recognition of national flags of all countries c) Recognition of House flags and funnels of Indian Shipping Companies. d) Recognition of flags denoting numbers and flags used as substitutes a) How to bend on or unbend a flag from halyard. Breaking a flag at close up. b) Flag hoisting practice at colours and sunset c) Morse signaling with Aldis lamp on mains and battery. d) Morse signaling with Daylight signaling Apparatus		

BOOKS RECOMMENDED FOR REFERENCE

1. Theory and Practice of Seamanship - G. Danton
2. Seamanship notes - Kemp and Young
3. Nicholls Seamanship - Brown, Son and Ferguson
4. Cargo Work - Kemp and Young
5. Seamanship primer - Capt. J.M.N. Dinger
6. Cargo Work - Capt. Errol Fernandes
7. International Code of Signals - Capt. O.O. Thomas

ENVIRONMENTAL SCIENCE PAPER - I

Course Code: BNS - 205

B. Sc. Nautical Science Syllabus

Marks:100

THEOPΨ

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Physical Meteorology** a) Characteristics of the Earth's Atmosphere. Composition, hydrostatic equation, equation of state for dry air and moist air. Density variation. Vertical layers of the atmosphere. Ozone depletion, air pollution. b) Energy Budget : Radiation laws – Emission, Reflection, absorption and scattering, Solar and terrestrial radiation, Greenhouse effect and global warming. Heat exchange processes. Radiation budget of the earth/ atmospheric system. Environmental lapse rate and inversion. Diurnal, seasonal and geographical variation of temperature. c) Water Vapour in the Atmosphere : Changes of state, specific, absolute and relative humidity, dew point temperature, humidity mixing ratio, Unsaturated and saturated states, super cooling, frost point, Diurnal and seasonal variation of water vapour. d) Adiabatic Process : Dry and saturated adiabatic lapse rates, Potential temperature. The tephigram and its uses. Stability analysis. e) Condensation and Precipitation Phenomena: Condensation and freezing nuclei, condensation forms: Dew, frost, mist, fog, haze and clouds. Visibility. Development and classification of clouds. f) Precipitation : Processes, forms and types. Principles and methods of surface meteorological observations.		
02.	**Oceanography** a) Physical Properties of Sea Water : Temperature, salinity, density and pressure – their relationship and measurement. Optical properties, sound and light in the sea, colour of the sea water. b) The energy budget of the Oceans : Spatial variation of temperature and evaporation. Heat balance. c) Salinity and Density : Distribution in surface layers of the ocean. Controlling processes. d) Oceanic Circulation System**:** Causes and spatial distribution of surface circulation. Seasonal changes d) Sub-Surface Circulation: Formation, source region and movement of water masses f) Oceanic Waves and Tides**:** Types of waves, wave energy, behaviour of waves in deep and shallow waters. Free and co-oscillations in basins. Tide-producing forces. Types of tides. Tide prediction and analysis, tidal streams, co-tidal charts. Storm surges and tsunamis.		

PRACTICAL

01.	**Meteorology:** The principles, construction and uses of various meteorological instruments, maximum and minimum thermometers, psychrometer/ hygrometer, anemometer, wind vane. Barometers (aneroid and mercury) and barograph.		

02.	**Oceanography:** 1. Use of main instruments and observational methods in the sea environment: Sensors for temperatures, salinity, depth, velocity etc.		

BOOKS RECOMMENDED

1. Marine Meteorology - Capt. H. Subramaniam
2. Atmosphere and Weather - Barry R.G., Chorley R.J.
3. Introduction to theoretical Meteorology - HESS
4. Meteorology for Mariners - HMSO
5. Marine Observer's Handbook - HMSO
6. Elementary Meteorology - HMSO
7. An introduction to Meteorology - James R. Holton
8. Introduction to Meteorology - Petterson B.
9. Physical Oceanography Vol:I and Vol:II - Defant A.
10. General Oceanography - Deitrich G.
11. Descriptive physical oceanography - Pick and G. and Emery W.
12. Oceanography for Geographers - Sharma R.C. and Emery W.
13. Introductory Dynamical Oceanography - Stephen Pond and G.L. Pickard

JOURNALS

1. Mausam - Published by IMD
2. Weather - Published by Royal Meteorological Society
3. Vayu Mandal - Published by India Meteorological Society
4. Bulletin of American Meteorological Society - American Meteorological Society

MARINE ENGINEERING AND CONTROL SYSTEM – PAPER I

Course Code: BNS - 206

Marks:100

THEOPΨ

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**MECHANICAL ENGINEERING SCIENCE** Strength of materials – Elasticity, Hook's Law – Stress and Strain		

	Tensile, Compressive and Shear forces Failure of materials under tension, compression, shear and fatigue. Examples related to Marine Engineering. Cantilever and simply supported Beams, Shear force and Bending Moments, calculation of stresses and B. M. Diagrams for above and other systems of the ship. Mechanical properties of common engineering materials – hardness, ductility, malleability, melting point etc. **Fluid Mechanics** – Flow of liquids and gases, Leminar and Turbulent flow, Resistance to flow **Viscosity** – definition and meaning **Bernoulli's Theory** : simple treatment Loss of energy of fluid due to bends, friction, valves etc. Simple hydraulic equipments. **Thermodynamics** : Properties of steam, Boiling point and effect of pressure on it, Saturated, dry and superheated steam, Dryness fraction. Meaning of Sensible Heat and Latent Heat.		
02.	**ELECTRICAL ENGINEERING SCIENCE** Electrostatics, Electro-magnetism and Electricity. Electric current, Voltage, EMF. Ohm's Law, Direct Current (DC) and Alternating Current (AC). Simple electrical circuits, Krichoff's Laws, simple calculations. Wheatstone Bridge.		
03.	**MARINE ENGINEERING PRACTICE** General Introduction and scope. Classification of ships as per propulsion plants. General layout of ship's Engine Rooms and machinery. Main engine Plants an supporting systems. Introduction about ship's Auxiliary Systems. Electrical Power Generation Plants – Its supporting systems and importance. Bilge, ballast, fire, cargo & other pipelines of different type of ships.		

PRACTICAL

MECHANICAL DRAWING Brief description of drawing papers, pencils, Instruments and their use. Types of lines and dimensioning. Loci of points, Orthographic projections, Projection of points, Straight lines, Planes, Solids. Isometric Projection. Concept of Form and shape, Plan, Elevation and End views of objects Contours, change of sections, hidden (Internal) construction, dotted lines etc. Discussion on ship's plans. Isometric views, cut/ cross-sections. Simple assembly drawings. Engineering drawing by free hand sketching		

BOOKS RECOMMENDED FOR REFERENCE

1. Engineering Drawing - Bhat
2. Engineering Knowledge for Deck Officers - Reed
3. General Engineering Knowledge - Reed
4. Mechanical Engineering Science - Hannah and Hiller
5. Marine Auxiliary Machinery - Souchette and Smith

B. Sc. Nautical Science Syllabus

CHART WORK PAPER - I

Course Code: BNS – 291

Max. Marks: 100

VOYAGE PLANNING

a) To find compass error by transit bearings. b) To find the position of a point on the chart by its latitude and longitude c) To find the position of a point on the chart by its bearing and distance from a navigational mark e) To plot ship's position given the compass bearings of two or more shore objects. The Cocked hat' and the reasons for its formation. f) To plot ship's position using three shore objects by horizontal sextant angles (given Horizontal sextant angle less than 90, equal to 90, or greater than 90). g) To plot a position line obtained by an astronomical observation h) To find compass course between two positions on the chart. i) To find the course and distance made good, given course steered, set and drift of current and leeway. j) To find the course and speed made good and the set and drift, given the course steered, speed, duration and the initial and final observed positions. k) To find the course from a given position so as to pass a lighthouse at a given position so as to pass a lighthouse at a given distance when abeam. l) To plot ship's position, given the rising or dipping bearing of a light. Caution during abnormal refraction. m) To plot ship's position, given vertical sextant angles and bearing of light house. n) To plot a position lines obtained by Radio Aids to navigation o) To find compass course to seer between two positions on the chart so as to counteract the given and drift of current and given leeway		

COLLISION PREVENTION : Syllabus same as theory

B. Sc. Nautical Science Syllabus

WEST BENGAL UNIVERSITY OF TECHNOLOGY
(KOLKATA)

SYLLABUS

FOR

THIRD SEMESTER B. SC. (NAUTICAL SCIENCE)

EFFECTIVE FROM - 2005-2006

THIRD SEMESTER

APPLIED MATHEMATICS – PAPER – III

Course Code: BNS – 301

Marks:100

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Bessel Functions and Legendre Polynomials** Relations between Laplace equation and Bessels differentials equation, Is solution by series methods, Bessel functions of first and second kind, recurrence relations for J(x), Generating function of J(x), Orthogonality of J(x), Bessel- fourier series of a function, Relation between Laplace equation and Legendre differential equation, Its		

	solution by series methods, Recurrence relations for Pn(x), Rodrigue's formula for P(x), Orthogonality of Pn(x), Legendre- Fourier series for a function.		
02.	**Partial Differential Equations** Partial differential equation governing Transverse Vibrations of an elastic string, its solution using Fourier Series, Vibrations of a rectangular and circular membranes. Heat equation, steady- state configuration for heat flow and Laplace equation in two and three dimensions, Variable heat flow in one dimension.		
03.	**Laplace Transforms** Function of bouned variation (statement only), Laplace transforms of t^n, e^{at}, sin (at), cos(at). Sin h(at), Cos h(at), shifting properties. Expressions (with profs) for : (i) $L\{t^n f(t)\}$ ii) $L\{f(t)\}$ iii)$L\{\int_0^t f(u)du$ iv) $L\{\frac{d^n f(t)}{dt^n}\}$ Unit step functions, heaviside, Dirac functions and their Laplace transform. Laplace transform of periodic functions. Evaluation of inverse laplace Transforms, partial fraction methods, Heavyset development, convolution theorem. Application to solve initial and boundary value problems involving ordinary differential equations with one dependant variable.		
04.	**Complex Variables** Functions of complex variable. Continuity (only statement) derivability of a function Analytic. Regular function. Necessary conditions for f(z) to be analytic. (Statement of sufficient conditions). Cauchy Riemann equation in polar co-ordinates. Harmonic functions, Orthogonal trajectories. Analytical and Milne – Thomson method to find f(z) from its real or imaginary parts. Integration of complex functions, Cauchy's integral theorem for simply connected regions, Cauchy's integral formula, Taylor's and Laurent's expansion, Zeros, Singularities, poles, residue at isolated singularity and its evaluation. Residue theorem, its application to evaluate real integrals.		

BOOKS RECOMMENDED FOR REFERENCE

1. A Text Book of Applied Mathematics Vol-II : Wartikar P.N. & Wartikar J.N.
2. Engineering Mathematics Vol-II : Sastry S.S.
3. Theory of functions of a complex variable : Shanti Narayan
4. Advanced Calculus : Wilfred Kaplan
5. Laplace Transforms : Schaum's Outline Series
6. Higher Engineering Mathematics : Dr. Grewal B.S.
7. Integral Calculus : Das & Mukherjee

NAUTICAL PHYSICS AND ELECTRONICS – PAPER III

Course Code: BNS – 302

Marks:100

B. Sc. Nautical Science Syllabus

THEORY

SECTION - A

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Review of a.c. circuits** Self inductance, inductive reactance, purely inductive circuit, a.c. through resistance and inductance, choke, numerical problems. Capacitance, capacitive reactance, purely capacitive circuit, a.c. through L-C-R circuit, series and parallel resonant circuits, power and power factor in a .c. circuits, numerical problems.		
02.	**Modulation concepts** Amplitude modulation, modulation index, power distribution in A.M. wave, linear modulation, square law modulation, diode modulator, transistor modulator, balance modulator, single side band generation, suppression of carrier. Frequency and phase modulation, F.M wave, modulation index, side bands in F.M. reactance modulator, comparison of A.M. and P.M., Phase Lock Loop and its advantages.		
03.	**Demodulation Techniques:** Demodulation of A.M. waves, diode detector, transistor modulator, detection efficiency, amplitude distortion,. Demodulation of FM waves, frequency demodulator, slope detector, balanced slope detector, ratio detector, frequency distortion.		
04.	**Transmission System:** Classification of amplifiers – A, B and C , AF, RF and power amplifier, AM transmitter, SSB (Single side band) transmitter, sideband filters.		
05.	**Digital Communications:** Types of pulse modulation, generation and demodulation of Pulse Amplitude Modulation (PAM) waves, distortion in PAM, pulse Duration (width) Modulation (PWM or PDM), Pulse position Modulation (PPM), generation and demodulation of PPM, Pulse code Modulation (PCM), generation and demoulation of PCM, direct FM transmitter, Armstrong FM system, mobile communication, frequency synthesizers.		

SECTION – II

IMO NO	THEORY	Teaching Methods	Teaching Material
06.	**Wave Propagations:** Basic electromagnetic spectrum, mechanism of wave propagation, field strength, propagation through troposphere, Propagation models, radio horizon, troposphere monitoring techniques, sky – wave propagation, ionosphere, microwave links and other communication links, noise in communication systems		
07.	**Radio receivers:** Straight and regenerative receivers, turned RF receivers, super heterodyne receivers. AM receivers, communication receivers, stereo FM multiplexed reception, single side band receiver, noise consideration, FM receiver performance		
08.	**Antennas:** Resonant antenna, antenna gain, radiation resistance, impedance matching, feeders, resonant line feed, grounded antennas, higher frequency antennas, dipole		

	arrays, Yagi – Uda antenna, Rhombic antenna, microwave antenna, active antenna, horn antenna, dielectric antenna.		
09.	**Transmission Lines:** Motion of electrical wave along line, characteristic impedance, infinite line, reflection of a wave on a line, resonant and non resonant lines, standing wave ratio (SWR), input impedance of a transmission line for use at VHF.		
10.	**Radar Communication:** Elements of radar system, radar rang, limitations of radar, radar altimeters and beacons interrogating radars, Instrument Landing System (ILS), Visual VHF Omni Range (VOR) Tactical Air Navigation (TACAN), Radio Direction Finding (RDF), LIDAR		
11.	**Satellite Communication:** Satellite links, ellipses, orbits and inclination, satellite construction, communication frequencies, domestic satellites, telemetry.		

PRACTICAL

IMO NO		Teaching Methods	Teaching Material
1.	Use of a CRO – measurement of voltage, frequency, time & phase shift.		
2.	Lowpass, High pass Filters (R-C)		
3.	Band pass & Band stop filters (R-C)		
4.	Series & parallel resonance (R-C-L)		
5.	Class A Power Amplifier		
6.	Amplitude Modulation		
7.	Frequency Modulation		
8.	Pulse Code Modulation – Generator & Demodulator		
9.	Study of PLL		
10.	Diode as a peak detector as a peak detector for A.M. & F.M		

NOTE: A minimum of 8 experiments are expected to be performed

BOOKS RECOMMENDED FOR REFERENCE

1. Communication Electronics : N.D. Deshpande, D.A. Deshpande, P.K. Rangole
2. Ship borne Radar : Capt. H. Subramaniam

ADDITIONAL REFERENCE

3. Electronic Communications : D Roddy J Coolen
4. Electronic Communication System : G. Kennedy

BOOKS FOR PRACTICALS FOR PAPERS I AND II

5. Communication Electronics : N.D. Deshpande, D.A. Deshpande, P.K. Rangole
6. Electronic – A Text Lab Manual : Zbar
7. Operational Amplifiers and Linear Integrated Circuits : Coughlin and Driscoll
8. Electronic device and circuit theory : Boylestad and Nashelsky

VOYAGE PLANNING & COLLISION PREVENTION – PAPER I I

Course Code: BNS – 303

Marks:100

THEOPΨ

SECTION A: VOYAGE PLANNING

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Elementary knowledge of Passage Planning and its execution. Landfall in thick and clear weather. The selection of a suitable anchorage.		
02.	To find the time and height of high and low water at Standard ports. The use of admiralty Tide tables and tidal curves to find the time at which the tide reaches a specified height or heights of the tide at a given time and thence the correction to be applied to soundings or charted heights of shore objects.		
03.	The interpretation of a chart or plan, particularly the information given about Lights, Buoys Radio Beacons and other Navigational Aids. Depths and height contours. Tidal Streams Traffic lanes and separation zones. Recognition of the coast and radar responsive targets Chart correction		
04.	Geographical range, Luminous Range, Nominal Range; and their significance		
05.	Development of electronic Chart display system		

SECTION B: COLLISION PREVENTION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	More detailed knowledge of ' International Regulations for Preventing Collision at Sea' than that at the first year level.		
02.	The IALA system of Buoyage – lateral and cardinal systems.		
03.	Precautions while using floating navigational aids such as buoys, light		

	vessels etc.		
04.	Radar Plotting exercises. Relative plot. Action by own shop, Action by Target ship. Set an Drift.		

COLLISION PREVENTION

IMO NO	THEORY	Teaching Methods	Teaching Material
1.	**The students will be required to identify various collision situations by day and by night**		
2.	Practicals to be held using a magnetic board, wooden models, overhead projector, video tapes or any other aid to simulate such conditions		
3.	Candidates will be required to deal with each collision situation broadly under the headings 'recognition', 'responsibility', action', 'appropriate sound signal and 'ordinary practice of seaman.		
4.	Collision situation in restricted visibility with or without Radar. Statutory obligations under both circumstances		
5.	Recognition of various buoys and marks under IALA system and appropriate actions required under the rules		

Note: The third semester examination will include the entire Practical portion of the 2nd year.

BOOKS RECOMMENDED FOR REFERENCE

1. Rule of the Road : Bhandarkar Publication
2. International Light, Shape and Sound Signals : D.A. Moore
3. Guide to collision avoidance : Cockroft
4. Maritime Buoyage System : I.A.L.A
5. Chart Work : Capt. S.K. Puri
6. Modern Chart Work : Squair
7. Navigation for Watch Keepers : Fifield
8. Ship Borne Radar : Capt. H. Subramaniam
9. Voyage Planning and Chart Work : Capt. M.V. Naik and Capt. Vaity
10. Nicholl's Concise Guide Vol-I : HMSO
11. Marine Chart Work : D.A. Moore
12. Manual of the Rule of the Road : Capt. S.K. Puri

BRIDGE PROCEDURES LEGAL KNOWLEDGE

Course Code: BNS – 304

Marks:100

B. Sc. Nautical Science Syllabus

THEORY

SECTION: A – BRIDGE EQUIPMENT

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Guidelines for watch keeping at sea and in port		
02.	Basic principles and use of radar		
03.	Principle of position fixing by hyperbolic lattice. Use of radio waves to obtain difference of distances by measurement of time difference or phase difference. Elementary knowledge of instruments using the above principle		

SECTION : B – MARINE COMMUNICATION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Introduction and use of Radio Communication Equipment on board ship for distress and safety selection of suitable frequencies.		
02.	Radio Regulations relating to maritime Services including maritime frequency allocation.		
03.	Satellite Communication and Alerting systems – Equipment on board and shore. Methods adopted.		
04	Global Maritime Distress and safety System – Principles and actual applications		
05	World Wide Navigational Warning System – India's role as a Co-ordinator for area 8.		
06	Meteorological Broadcast – Routine weather messages and storm warnings		
07	Search and Rescue Communications		

SECTION : C - LEGAL KNOWLEDGE

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Merchant Shipping act 1958 with special reference to General Administration, Procedure and Certificate of Registry, Passenger Ships, Certificates and other documents required to be carried on a ship – How obtained and their validity.		
02.	Certificate of Officers, Seaman and Apprentices, Engagement, Management, and discharge of crew, Manning scales and Contracts of employment, Wages and other remuneration, advances, allotments, Money orders, payments into bank accounts. Desertion, deceased seaman, engagement of substitutes, repartriation.		
03.	The Official Log Book and the law relating to entries therein. Offences relating to misconduct to endangering ship against persons on board. Discipline and treatment to disciplinary offences.		

04.	Crew accommodation. Hygiene of the ship and welfare of the Crew. Inspection and reports. Fresh water and provisions. Procedure in cases of infectious diseases, illness or accident. Maritime declaration of health. Port health requirements.		
05.	Custom House procedure, entering and clearing ship..		
06.	Load Line marks, Entries and reports in respect of freeboard. Draft and allowances. Calculations on Lay days and Load Line (Zone Problems		
07.	Safety of the ship, crew and passengers. Assistance to vessels in distress and salvage. Duties of Master in the Case of an accident.		
08.	The law relating to the reporting of derelicts, tropical revolving storms and other dangers t navigation.		
09.	Compulsory and non-compulsory pilotage.		
10.	A General knowledge of shipping practice and documents with particular reference to charter parties, bills of lading and Mates receipts. The law relating to carriage of cargo and the ship owners liabilities and responsibilities. Protests, certificate of sea worthiness.		
11.	A knowledge of the contents of " Merchant Shipping Notices" and Notices to Mariners. The use of Notices to Mariners		

PRACTICAL

BRIDGE EQUIPMENT

IMO NO		Teaching Methods	Teaching Material
01.	**Echo Sounder:** Use and care of both visual and graphic types. To take soundings using echo sounder or Echo sounder simulator		
02.	**RADAR:** Practical adjustment of operational controls to their optimum setting. To carry out performance check, using performance monitor. To take ranges and bearings of fixed and moving object. To identify land objects using radar observations. Evaluation of risk of collision. Use of reflection plotter.		

MARINE COMMUNICATION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Practical usage of ' International Code of signals'		
02.	To prepare portable radio equipment for operation		
03.	Ship to ship to shore communication exercises by portable VHF sets.		

BOOKS RECOMMENDED FOR REFERENCE

1. Electronic Navigation Aids : Sonnenberg
2. Ship Borne Radar : Capt. H. Subramaniam

3. International Code of Signals : HMSO
4. Telecom hand book for Radio operators
5. Business and Law for ship Master : Hopkins
6. Indian Merchant Shipping Act : Bhandarkar Publications
7. Ship's Business : Bonwick and Steer
8. SOLAS : IMO Publication
9. MARPOL : IMO Publication
10. International Convention on Load Lines : IMO Publication
11. Medical First Aid guide : IMO Publication
12. Search and Rescue Manual : IMO Publication
13. Annual Notices to Mariners : Hydrographic department
14. Weekly notices to Mariners : Hydrographic department
15. Merchant Shipping Notices : Bhandarkar Publications

ENVIRONMENTAL SCIENCE PAPER - II

Course Code: BNS – 305

Marks:100

LAND-OCEAN-ATMOSPHERE INTERACTION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Formation of the earth and its structure – Evolution of continents and ocean basins – Continental drift hypothesis – concept of isotasy and its application to surface phenomena – Recent ideas on drift: Plate tectonics – practical significance or recent information.		
02.	Materials of the earth's crust: minerals and rocks – rock types and their formation – Lithological characteristics and their impact on landform development – Tectonic landforms. Folds, faults and associated features – Volcanic and seismic activities: associated landforms.		
03.	Exogenic forces: denudation – Weathering, mass – wasting an erosion Marine landforms – Sea level changes – classification of coasts.		

OCEANS

IMO NO	THEORY	Teaching Methods	Teaching Material

01	Fundamental of Ocean Science Major relief features of the ocean – flow – Botton relief of Indian, Atlantic and Specific Oceans – properties of ocean water: temperature, salinity and density – their vertical and horizontal distribution – ocean currents : factors and patterns – ocean deposits : types and their work – NIO and its activities.		
02.	Biotic resources of the oceans : fish , corals , mangroves, etc. – distribution of biotic resources – problems of their exploitation – environmental and other stresses – remedial measurers – mariculture : merits and limitations		
03.	Abiotic resources : Types – oceanic minerals nodules and placers – oil and natural gas – technological advance – marine politics and law of the sea – environmental oceanic problems and oceanic hot spots – futures of scenario.		
04.	Oceanic water as a resource: Navigation, power generation, source of drinking water etc. – spatial pattern of feasibility – oceanic islands and their strategic significance – Indian ocean island.		

ATMOSPHERE

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Factors affecting atmospheric motion and the resulting winds – newton's laws and equation of motion – basic patterns of air movement		
02.	Horizontal and vertical distribution of atmospheric pressure and the resulting circulation. Recent advances in the knowledge of general circulation: upper airwaves and jet stream – Dynamics of the Indian monsoon.		
03.	Seasonal weather and climatic characteristics over India – cyclones in Indian Seas and their impact on Coastal life.		
04.	Weather forecasting methods and techniques – constraints in accurate forecasts.		

PRACTICAL

IMO NO		Teaching Methods	Teaching Material
01.	Identification of common rocks and minerals		
02.	Reading and interpretation of topographical maps of coastal areas.		
03.	Plotting of tephigrams and their interpretation		
04.	Tracking of cyclones		
05.	Estimation of geostrophic wind speed from geostrophic scale.		
06.	Reading and interpretation of hydrographical charts		
07.	Preparation and interpretation of tidal charts.		
08.	Plotting of weather details at surface stations.		
09.	Reading and interpretation of IMD synoptic maps		
10.	Interpretation of upper air charts.		

BOOKS RECOMMENDED FOR REFERENCE

1. Anoutline of Geomorphology : Wooldridge, S. W. & Morgan R. S.

2. Continental Drift : Tarling D. H. & Tarling M. P
3. Putnam's Geology : Birkland P. W. & Larson E. E
4. Principles of Physical Geography : Monkhouse F. J.
5. Principles of Geolorphology : Thornbury W. D
6. Oceanography: Exploring the Ocean : Bhatt, J. J
7. Oceanography for Geographiers : R. C. Sarma & M. Vatal
8. Climate & Weather : H. Flohn
9. World Climate & Weather : D. Riley & I. Spolton
10. Introduction to Meteorology : A. Petterssen
11. Introduction to Meteorology : F. W. Cole
12. The Atmosphere : R. A. Anthes
13. Climatology from Stallites : E. C. Barrett
14. Introduction to Climatology for the Tropics : J. O. Ayoade

JOURNALS

1. MAUSAM

MARINE ENGINEERING AND CONTROL SYSTEM – PAPER II

Course Code: BNS – 306

Marks:100

THEORY

MECHANICAL ENGINEERING SCIENCE

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Engineering Materials – common Engineering materials. Various metals & alloys, Properties & uses. Ceramics and their use. Steels – Elementary metallurgy of steels, steel production – smelting & refining. Iron-Carbon diagrams to show role of carbon in steels and effect on properties. Diagram to show role of carbon in steels and effect on properties. Types of steel and use . Heat treatment – Heat treatment of steels – obtaining desired properties from steel for use in different areas.		

ELECTRICAL ENGINEERING SCIENCE

B. Sc. Nautical Science Syllabus

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**AC & DC machines:** DC generators. AC generators. Meaning of frequency, phase & power factor, parallel running & load shearing. Prime mover – Diesel engine, steam turbines. AC & DC Motors.		
02.	**Transformers:** high and low voltage transformers, step up / step down / transformers, transformer efficiency and maintenance and care		
03.	**Power distribution :** Main switch boards , power distribution boards, Circuits breakers, Measuring instruments , overload trip short circuit trip, fuses other protections		

MARINE ENGINEERING

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Auxiliaries a) Fresh water: Methods of generation of freshwater from seawater at sea. Principle, construction & operation of freshwater generator, steam evaporator, flash evaporator & reverse osmosis plant. Treatment of water for obtaining portable water. Storage and supply of fresh water in ships. Fresh water and sanitary water. Hydro phase systems. b) Compressed air: Air compressor, uses of compressed air. Storage and distribution of compressed air. c) Steam: Types of marine steam boilers. Construction and operation o water tube and smoke tube boiler. Boiler mountings, accessories, safety features. Waste heat recovery boilers. Boiler maintenance. Importance of boiler. Feed water chemical treatment. d) Refrigeration & Air conditioning: Principle of refrigeration, compression refrigeration cycle, components & operations. Arrangement of cold storage holds.		
02.	Auxiliaries a) Pumps : working principle, construction of different types of pumps . Selection of pumps for different duties on board the ship. b) Steering : Common types of steering gear, Electro hydraulic steering gears, two and four Ram systems , telemotor and control systems . Safety features. Emergency arrangements. Legislation National and international, operations and maintenance. Internal Combution Engine. a) Working principles : classification of various types of engines, various types of modern diesel engines. Basic principles of cycles, P-V diagrams, work done etc. 4 stroke and 2 stroke engines. Components : construction , main components and working of 2 & 4 stroke engines.		

PRACTICAL

BASIC MARINE WORKSHOP

IMO NO		Teaching Methods	Teaching Material
01.	a) Cutting, filling, preparation of level surfaces on metals b) Drilling, tapping reamer operations c) Shaping drilling, grinding operations d) Edge preparation on steel objects for welding e) Welding of simple joints f) Removal and fittings of ball bearing g) Overhaul of valves practice on fittings on pipelines. i) Compentency - Cutting and planning , dove tail joints		

BASIC ELECTRICAL WORKSHOP

IMO NO		Teaching Methods	Teaching Material
01.	Electrical wiring diagrams and fittings of simple circuits		
02.	Fuses, earthings, tube and other light fittings, etc. practice training		

BOOKS RECOMMENDED FOR REFERENCE

1. General Engineering Knowledge for Marine Engineers : L. Jackson and T. Morton
2. Reeds Engineering Knowledge for deck officers : W. Embleton and T. Morton
3. Basic Electro Technology for Engineers : Thomas Reed Publications Ltd.
4. Marine Engineering Series – Marine Boilers : GTH Flanogan
5. Marine Engineering Series – Marine Diesel Engineers : Heinemann Punlishing Ltd.
6. Marine Auxiliary Machinery : DW Smith, Butterworth
7. Marine Electrical Practice : Butterworth

CHART WORK – II

Course Code: BNS – 391

Max. Marks : 100

B. Sc. Nautical Science Syllabus

IMO NO		Teaching Methods	Teaching Material
1.	To determine ship's position by the 'Running Fix' method with and without current.		
2.	To find the ship's position by 'doubling the angle on the Bow' method		
3.	The use of a station pointer to plot ship's position – given two horizontal angles.		
4.	Use of single position line obtained from a celestial observation when near a coast to keep safe distance off the coast.		
5.	Fixing the position of a ship using bearings obtained from a D.F. set. Conversion of DF bearing to Mercator bearing		
6.	To find course made good using the three point bearing method		

WEST BENGAL UNIVERSITY OF TECHNOLOGY

(KOLKATA)

SYLLABUS

FOR

FOURTH SEMESTER B. SC. (NAUTICAL SCIENCE)

EFFECTIVE FROM - 2005-2006

FOURTH SEMESTER

COMPUTER SCIENCES

Course Code: BNS – 401

Marks:100

THEORY

B. Sc. Nautical Science Syllabus

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Computer Fundamentals** Historical development of computers: an evolution. Classification of Computers on different norms such as generations, technology, etc. Different functional parts of a computer and their functions. Computer peripherals: Monitor, Printer, Key Board, Floppy disk drive, Floppy, Hard disk, Mouse. Computer arithmetic: Binary, Octal, Decimal & Hexadecimal number systems and mutual conversion: addition, 1's & 2's complementation in binary only. Units of memory measurement: Bits, Bytes, KB, MB, GB, and TB. Units of run-time measurement: sec, ms, μs, ns, ps, fs, as. Different computer environments: Batch processing, Time-sharing, Interactive & Network, their functional details and differences. Computer connectively: LAN, MAN, WAN, Internet. Internet activity in India and various facilities available on Internet, Satellite based Communication.		
02.	**C Language** Computer languages, their classification and compilation. C- character set. Data Types. Constants and variables. Operators: Arithmetic, Increment & Decrement, Modulo division, Relational, Logical, conditional and Comma. Expressions and Assignment statements. Control statements: if, nested if, switch, while loop, for loop, do while loop. Arrays: single and two-dimensional only. Functions: User defined, standard library functions of various types. Pointers: &, * operators. Pointer expression: pointer assignment, pointer arithmetic, pointer comparison, and structure. File handling in C: Opening a file, write into a file, reading from a file, closing a file.		

PRACTICAL

Programs are to be written, tested and filed for certification by teacher/ head of Institution

IMO NO		Teaching Methods	Teaching Material
01.	Finding n!		
02.	Finding GCD of two numbers		
03.	Solution of a quadric equation		
04.	Simple and Compound interest		
05.	Mean and standard deviation		
06.	Sorting of numbers		
07.	Finding real distinct roots of an algebraic equation: Newton – Raphson method		
08.	Creating a database of students using file operations		
09.	Problems based on nautical sciences		

BOOKS RECOMMENDED FOR REFERENCE

1. Turbo C reference manual
2. Programming in C : Kris A. Jamsa - Galgotia Publication Pvt. Ltd.
3. Mastering Turbo C : Kelly / Bootle - BPB Publication
4. Turbo C Programming Techniques : BPB Publication

5. Computer Virus : BPB Publication
6. Introduction to Computer Science Vol I & II : Jains - BPB Publication
7. Introducing Computers Vol I, II & III : Mehtas - BPB Publication

APPLIED MATHEMATICS – PAPER – IV

Course Code: BNS – 402

Marks:100

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Numerical methods** Solutions of transcendental & algebric equations: Newton – Raphson method, bisection method. Finite differences of first and higher order, forward, backward, central and divided differences, difference tables, Taylor's operator – D, shift operator – E, averaging operator, differences of polynomials. Interpolation: linear and quadric interpolation, Newton's forward and backward difference interpolation formulas, Langrangian interpolation, Sterling and Bessels' interpolation formulas. Numerical integration: rectangular and trapizodial rule, Simpson's rules. Solutions to systems of linear algebraic equations: Gause elimination, Gauss Jordan method, Gauss – Seidel interation, Jacobi iteration.		
02.	**Matrices** Types of matrics. Adjoint of a matrix. Inverse of a matrix. Elementary transformations, rank of a matrix. Linear dependant and independent of rows and columns of a matrix over a real field. Reduction to a normal form. Partitioning of matrices. System of Homogeneous and non homo-geneous linear equations, their consistency and solution. Characteristic values and vectors, and their properties for Hermitian and real symmetric matrices. Characteristic polynomial. Cayley Hamilton theorem. Functions of a square matrix, Minimal polynomial, Diagonable matrix. Quadric forms, orthogonal, congruent and Lagrange's reduction of quadric form. Rank, Inex, Signature of quadratic form.		
03.	**Statistics** Frequency distribution, Measures of central tendency; Mean, Median and Mode, measures of variability, range, Percentiles, Variance, Standard Deviation, Skewness, Moments, Discrete randon variables and their probability distributions. Bionomial and Poisson's distributions, continuous random variables, Normal distribution, Properties of Normal distribution, Probability Expectation, Random experiment on probability. Coefficient of Correlation, Lines of Regression – Rank correlation. Elements of operation Research – Inventory control and Elements of Quequeing Theory. Decision Trees.		

BOOKS RECOMMENDED FOR REFERENCE

1. A Text Book of Applied Mathematics Vol-I : Wartikar P.N. & Wartikar J.N.
2. A text book of Materices : Shanti Narayan

3. Mathematical Statistics : Kapur J.N. and Saxena H.C.
4. Statistics in Schaum's Series : Murray Spiegal
5. Statistics and Probability for Engineers : Myers
6. Higher Engineering Mathematics : Dr. Grewal B.S.
7. Numerical Methods for Engineers : S.K. Gupta
8. Operations Research an introduction : Taha H.A.
9. Operations Research Methods & problems : Srieni Yaspan Friedman
10. Linear Programming : Hadley G.

NAUTICAL PHYSICS AND ELECTRONICS – PAPER IV

Course Code: BNS – 403

Marks:100

THEORY

SECTION: A – Analog Circuits

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Transistor Biasing:** Operating Point, Base bias (Fixed bias), Emitter bias, Voltage divider bias, D.C. load lines, Transistors saturation, Transistors as a switch, Bias Stabilization		
02.	**Transistor Amplifier:** C.E. amplifier, DC and AC equivalent circuits, Small signal operation, voltage gain, current gain, Input and output impedance, Frequency response, DC and AC load lines, Class A operation, Power gain, Decibel voltage gain, A typical emitter follower circuit.		
03.	**Operational Amplifier:** The basic differential and Common Mode Operation, Basic Opamp Specifications, Practical Opamp circuits – Schmitt Trigger and square wave generator, Inverting and Non-inverting amplifiers, voltage follower, summing amplifier, Difference Amplifier. Integrator and Differentiator.		
04.	**Feedback types:** Voltage and current feedback, Effects of negative feedback n amplifier parameters, derivation only for gain with feedback (No other derivations), typical single transistor circuits for voltage series and current series feedback. Oscillator operation, Barkhausen criteria, RC oscillators – phase shift and Wein Bridge (op-amp and transistors), LC oscillators – Colpitts and Hartely (transistor and op-amp), crystal oscillator.		
05.	Cathode Ray Oscilloscope - construction, working, basic measurements		

B. Sc. Nautical Science Syllabus

SECTION B: Digital Circuits

IMO NO	THEORY	Teaching Methods	Teaching Material
06.	**Number System and Logic gates:** Binary numbers, binary to decimal conversion, decimal binary conversion, (Octal and hexadecimal numbers, Binary to octal and binary to Octal and binary – Hexadecimal inter conversion), NOT, OR, AND, NAND, NOR Logic gates, EXOR Gate, arithmetic a data processing circuits (half adder, full adder, multiplexer and de multiplexer), De Morgan Theorems, Boolean algebra, NAND and NOR as a basic building blocks, Logic levels TTLICs.		
07.	**Clocks and Timers:** 555 timer, basic timing concept, 555 block diagram, monostable and astable multivibrators, Voltage controlled Oscillator (VCO), ramp generator NAND gate as a clock		
08.	**Flip flops and counters:** RS flip flop, Clocked RS flip flop, D flip flop, JK flip-flop, Master Slave concept, Schmitt trigger, Flip-Flops used as binary ripple counters, decade counter.		
09.	**Microprocessors:** Digital Computers, Computer languages, Single Chip Microprocessor architecture and its operations, Memory, Input an output (I/O) devices, Interfacing devices, Example of a microcomputer system. The 8085 microprocessor, example of 8085 – based microcomputer, memory interfacing, how does an 8085 – based single – board microcomputer work?, basic interfacing concepts, interfacing output displays and input devices, memory mapped I/O, 8085 programming model, instruction classification, instruction format, how to write, assemble and execute a simple program, overview of 8085 instruction set		

PRACTICAL

IMO NO		Teaching Methods	Teaching Material
1.	CE Amplifier – voltage gain, frequency response, plotting A.C. & D.C. load lines		
2.	Emitter Follower – voltage gain & output resistance.		
3.	Op-Amp – inverting & non-inverting amplifier, voltage follower, summer & difference amplifiers		
4.	Op-Amp – square wave generator, slew rate.		
5.	555 timer – a stable & monostable multivibrators		
6.	Wien Bridge Oscillator – transistor & op-amp versions		
7.	Study of Basic logic gates – NOT, AND, OR, NAND, NOR		
8.	DeMorgan's Laws & use of NAND & NOR as basic building blocks.		
9.	J-K Flip Flop – turth table, Ripple & Decade counters.		
10.	Microprocessors:		

	a) Learning (get to know) the Hardware of a microprocessor b) Operating procedure, precautions & use of key- board of a microprocessor c) Use of commands & keys of a microprocessor to solve simple problems d) Writing & running simple programs e) Simple Input & Output programs		

NOTE: A minimum of 8 experiments are expected to be performed

BOOKS RECOMMENDED FOR REFERENCE

1. M. Electronic Principles : Malvino
2. BN Electronic devices and circuit theory : Bolystead & Nashelesky
3. ML Digital Principles and Applications : Malvino & Leach
4. G: Microprocessor Architecture, Programming and Application – 2nd Edition (Wisley Eastern) New Age International : Ramesh Gaonker
5. Digital Principles and Applications
6. Operational Amplifiers and Linear Integrated Circuits : Coughlin and Driscoll
7. Electronics : A Text-Lab Manual : Zbar and Malvino
8. Microprocessor Architecture, Programming and Application : R.S. Gaonker

PRINCIPLES OF NAVIGATION – PAPER I I
Course Code: BNS – 404

Marks:100

THEORY

SECTION : A – PRINCIPLES OF NAVIGATION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	The celestial sphere, celestial poles, equinoctial, declination, celestial meridians, vertical circles, prime vertical, Ecliptic, First point of Aries, RA, SHA, GHA, LHA. V		

	and d corrections for moon and planets. Position of a heavenly body on celestial sphere by its declination and GHA, or by its altitude and azimuth, or by its celestial latitude and longitude.		
02.	Visible, sensible and rational horizons, zenith, nadir, sextant altitude, apparent altitude, correction of altitude, dip, refraction , semi – diameter, parallax in altitude, horizontal parallax, augmentation to moon's S.D, reduction to H.P. True altitude and True Zenith dist. Total correction tables. Artificial horizon & correction of altitudes there from; back angle altitudes.		
03.	True and apparent motion of bodies. Solar time, Solar day, apparent sun, mean sun and dynamical mean sun; equation of time. Time and hour angle, Hour circles, Greenwich time local time, zone time & standard time. Keeping time at sea, advancing & retarding of clocks with change of longitude; International date line.		
04.	Sidereal time, sidereal day, why stars rise four minutes earlier each day, conversion of solar time to sidereal time and vice-versa		
05.	Azimuths and amplitudes: Derivation of formula: Sin amp = Sin decl. Sec lat. Apparent altitude of Sun, Moon at time of theoretical rising or setting		
06.	Rising culmination and setting of heavenly bodies. To find time of meridian passage, sunrise, sunset, moon rise and moon set by calculation and by perusal of nautical almanac with appropriate correction		
07.	Principles of position lines. Geographical position, circle of position, why P/L is at right angles to the Azimuth – exceptions. Positions to draw the P/L – Intercept method; Longitude by chronometer method and Ex-meridian method. Effect of change of DR position on position for P/L and practical applications.		
08.	Simple calculations on 1 to 7above.		

BOOKS RECOMMENDED FOR REFERENCE

1. Principles of Navigation : Capt. P.M. Sharma
2. Principles of Navigation : Capt. Joseph and Capt. Rewari
3. Practical Navigation : Capt. H. Subramaniam
4. Admiralty Manual of Navigation Vol-I and Vol-II
5. Navigation : A. Frost
6. Nicholl's Concise Guide Vol-I and Vol-II
7. Nutshell Booklet on Sextant : Capt. H. Subramaniam

SHIP OPERATION TECHNOLOGY PAPER – II

Course Code: BNS – 405

B. Sc. Nautical Science Syllabus

Marks:100

THEORY

SECTION: A – CARGO WORK

IMO NO	THEORY	Teaching Methods	Teaching Material
1.	Introduction to codes and guidelines for carriage of bulk chemicals, bulk gas.		
2.	Planning stowage of general cargo taking into account stowage factor, port rotation, hazardous nature, special stowage requirements relating to cargoes not covered by special codes.		
3.	Principles of stowage/ securing of all types cargoes taking into account ship's motion at sea.		
4.	Factory act. requirements for annealing and periodical testing of Cargo gear, chain register other requirements of the Factory Act.		
5.	Safety of personnel in handling any type of goods using EMS, MFAG, code of safety practices for marchant seaman, General outline knowledge of Indian Dock Labour Regulations. Machinary for handling of cargoes such as : Derrick and rigs, Cranes, Heavy lift crane / derrick, Winches including self tension winch, Conveyor belt/ chute arrangements, container handling systems.		
6.	Infrastructure built in ports for loading and discharging, such as cranes, gantries, conveyor belt system etc.		
7.	Calculations relating to above topics where applicable.		

SECTION: A – SEAMANSHIP

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Anchor Work:** Different types of anchors. Cables and their care. Anchoring procedure. Duties on anchor watch. Use of second anchor. Foul anchor or hawse. Hanging off an anchor, breaking and slipping cables. Mooring – standing Moor, Running Moor		
02.	**Survival at sea:** Boat drills and musters. Action prior to, and after abandoning ship. Managing the craft and personnel in the craft. Handling of the craft. Landing signals. An outline knowledge of SOLAS requirements of LIFE SAVING APPLIENCES.		
03.	**FIRE PREVENTION AND FIRE FIGHTING:** Causes of fire. The fire triangle. Principles of fire fighting. Types of fire and methods of extinguishing each type. Various methods of detection and fighting of fire. Causes of fires in tankers during various operations carried out by tankers and its prevention methods. Outline knowledge of SOLAS requirements on FFA		
04.	**SHIP MANOEUVRING** Effect of various factors on manoeuvring. Berthing and unberthing at quays and oil terminals. Management of ship in heavy weather. Precautions in manoeuvring for lunching of boats or life rafts in bad weather. Methods of taking on board survivers from life boats and life rafts.		

05.	**General** Properties and uses of paints resins and other protective coverings. Preparations for dry docking and undocking. Use of side shores, bilge blocks and bilge shores. Measures to be taken to prevent spillage of oil during cargo work, bunkering or oil transfer. Keeping oil record book		

PRACTICAL

SEAMANSHIP

IMO NO		Teaching Methods	Teaching Material
01.	To repeat all practicals pertaining to Life Saving and Fire Fighting contained in the syllabus for 2nd semester in the 'Ship Operation Technology' paper.		
02.	To take soundings using hand lead line. Correct procedures of reporting.		
03.	Use of bow stopper, Devil's Claw		
04.	To disconnect and connect a lugless shackle.		
05.	Coiling of ropes – opening a new coil of rope. Cutting wire ropes.		
06.	Rigging a pilot ladder – Precautions for safety of men boarding by such ladders.		
07.	To renew manropes on boat davit span		
08.	To send distress signals		

BOOKS RECOMMENDED

1. Cargo Work : Kemp and Young
2. Stowage of Cargo : O.O. Thomas
3. Theory and Practice of Seamanship : Danton
4. Seamanship Notes : Kemp and Young
5. Seamanship and Nautical knowledge : Nicholls
6. Seamanship and Cargo Work : Capt. J.M.N. Dinger
7. Life boat and Life raft : Capt. S.K. Puri
8. Survival at Sea : C.H. Wright

NAVAL ARCHITECTURE PAPER - II
Course Code: BNS – 406

Marks:100

B. Sc. Nautical Science Syllabus

SECTION : A – SHIP STABILITY

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Use of Simpson's rules in the computation of areas, volumes and centroids.		
02.	Determination of position of the longitudinal center of gravity of a ship for different conditions of load and ballast. The effect on the position of center of center of gravity of a ship by adding, removing and / or shifting weights.		
03.	Longitudinal center of buoyancy, Longitudinal metacentre and center of flotation and factors affecting their positions.		
04.	Theory of Trim. Changes of trim and draft due to loading, discharging and shifting weights.		
05.	Change of trim due to change of density.		
06.	Use of stability, hydrostatic nd stress data supplied to ships.		
07.	Cross curves of stability , K. N. values, determination of Righting moment using K.N. values, Curve of statical stability and its practical usage.		
08.	Carriage of deck cargoes and their effect on stability.		
09.	Stowage of grain and stability aspects in respect thereof with particular reference to calculations involved and the manner of presentation of the information relating to grain heeling Moments and the resulting angle of heel as presented in the National Statutory Regulations		
10.	Calculations based on the foregoing including those based on " Trim and Stability Particulars" of a given ship.		

SECTION : B – SHIP CONSTRUCTION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Longitudinal and transverse framing, Beams and Beam knees. Functions, construction and stiffening of water tight bulkheads including collision bulkhead. Shell and deck plating.		
02.	Bilge Keels. Double bottom and peak tanks. Side and wing tank. Bilges.		
03.	Construction, stiffening and closing arrangements of openings on deck and superstructures.		
04.	Sounding pipes, air pipes, ventilators. Hawse-pipes, spurling pipes and their securing arrangements.		
05.	General pumping arrangements – Bilge and ballast line systems. Pumping arrangements on tankers. Methods adopted to maintain integrity of divisions and opening in the hull including stern, side and bow doors.		
06.	Rudders, construction and support. Stern frame, Propellers and Propeller shaft; stern tube and adjacent structure.		
07.	General ideas on various plan supplied by shipyard. Midship sections of General cargo ship, tanker, bulk carrier, container, OBO		
08.	Stress and strains in ships in still water and in a seaway. Parts of ship specially strengthened and stiffened to resist such stresses including panting and pounding		

09.	Causes and methods of corrosion control in steel work and also between dissimiliar metals including cathodic protection. Impressed current systems.		
10.	An outline knowledge of the functions of Clarification Societies. Surveys for assignments and retention of class		

BOOKS RECOMMENDED FOR REFERENCE

1. Shi Stability I, II, III : Capt. H. Subramaniam
2. Merchant Ship Stability for Masters and Mates : Deret
3. Notes on Stability : Kemp and Young
4. Stability for Merchant Ships : Capt. Lester
5. Stability : La Dage and Gemert
6. Problems on Hindship : Capt. Joseph and Rewari
7. Ship Construction for Marine Students : Reeds
8. Ship Construction : Kemp and Young
9. Ship Construction : Eyres
10. Ship Construction : Pursey
11. Ship Construction : Taylor
12. Grain Code : IMO

PRACTICAL NAVIGATION – PAPER I I

Course Code: BNS – 491

Max. Marks:100

IMO NO		Teaching Methods	Teaching Material

01.	To find the true Azimuth of a heavenly body, the compass error and hence the deviation of the magnetic compass for the direction of the ship's head (ABC tables)		
02.	To find the compass error and deviation fro amplitude of Sun and Moon		
03.	To find the latitude by meridional altitude of a heavenly body. To calculate meridian passage time and approx meridian altitude for setting on the sextant (computed altitude)		
04.	Latitude and position line by observation of polaris		
05.	From an observation of any heavenly body near the meridian, to find the direction of the position line and latitude corresponding to the D.R. longitude through which the passes. Time limits for ex-meridian sight		
06.	To find the longitude corresponding to the DR latitude through which the position line passed and the direction of position line from an observation of any heavenly body. (long by chron)		
07.	To find the intercept, intercept termination point and direction of position line from observation of any heavenly body. (intercept method)		
08.	Sextant: To use sextant for altitude of heavenly bodies viz. Sun, Stars, Planets and Moon thence to correct the sextant altitude to 'True alt' required for astronomical calculations.		
09.	Use of Azimuth Mirror and pelorus		

B. Sc. Nautical Science Syllabus

WEST BENGAL UNIVERSITY OF TECHNOLOGY
(KOLKATA)

SYLLABUS

FOR

FIFTH SEMESTER B. SC. (NAUTICAL SCIENCE)

EFFECTIVE FROM - 2005-2006

FIFTH SEMESTER

PRINCIPLES OF NAVIGATION PAPER – III

Course Code: BNS – 501

Marks:100

THEORY

SECTION : A – PRINCIPLES OF NAVIGATION

IMO	THEORY	Teaching	Teaching

B. Sc. Nautical Science Syllabus

NO		Methods	Material
01.	Birth of universe stars, Planets and their satellites. Signs of the Zodiac. Recognition of principal stars with reference to their Constellations. Stellar magnitudes.		
02.	Kepler's Laws. Distance of planets from the Sun. Bodes law. Inferior and superior planets. Axial revolution of planets. Relative motion of planets in their orbits. Elongation; Morning and Evening stars, Reasons for change of SHA/ RA of Sun, Moon and planets. Direct and retrograde motion of planets. Solar prominences, solar spot cycle and its effect on terrestrial magnetism.		
03.	Earth-moon system, moon's orbital and axial rotation, phases of the moon, liberation. Lunar month. Eclipses – Solar & lunar, Conditions necessary for occurrence of a solar or lunar eclipse. Umbra and Penumbra. Path of totality. Occultation of a planet or star. Procession of equinoxes.		
04.	Twilight – Civil, nautical and astronomical – conditions necessary for twilight all night; calculation of time of twilight by perusal of almanac with appropriate corrections, simple calculations based on above.		
05.	Circumpolar bodies; conditions necessary for a body to be circumpolar. Maximum azimuth. Problems on these topics		
06.	Great circle sailing – Initial & Final courses and distances, Pole, Vertex, course on crossing the equator. Figure drawing of a GC track approximately to scale. Composite great circle sailing.		
07.	Relationship between tides & phases of the moon – spring and neap tides; priming & lagging.		
08.	Familiarity with all the contents of nautical almanac and its usage.		
09.	Calculations based on 1st and 2nd year's portion of Principles of Navigation, together with (1) to (7) above		

SECTION : B – PRACTICAL NAVIGATION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Solution of Spherical triangle by Haversine formula. Sine formula. Cosine formula, Four part formula & Napier's Analogies.		
02.	Application of right angled & quadrantal spherical triangles.		
03.	To obtain a position by use of position lines obtained from two more observations with or without run (Simultaneous or staggered). The cocked hat and its interpretations.		
04.	Practical problems on Great Circle sailing. Use of ABC tables to find initial course, final course, Pole and Vertex of a Great Circle & great circle distance. Practical problems on composite circle.		
05.	Calculations based on 1st and 2yrs. Portion of Practical Navigation, together with (1) to (4) above		

PRACTICAL

IMO NO		Teaching Methods	Teaching Material

01.	**SEXTANT :** To use Sextant for the accurate measurement of vertical & horizontal sextant angles. To identify adjustable errors of this sextant and to correct such errors. To measure altitudes of heavenly bodies when possible and do sight calculation.		
02.	**GYRO COMPASS** : To know procedure of starting & stopping of Gyro Compass. Routine maintenance. Use of Azimuth ring to take bearings of both celestial and terrestrial objects.		
03.	**Meteorological Instruments :** To take observations and apply corrections to obtain accurate barometric pressure using both Mercurial & Aneroid Barometers. To take readings on Barograph and measure pressure tendency. To obtain Relative Humidity using dry & wet bulb thermometer. The use of Psychrometer. Use of anemometer and wind wane.		

BOOKS RECOMMENDED FOR REFERENCE

1. Principles of Navigation : Capt. P.M. Sharma
2. Practical of Navigation : Capt. H. Subramaniam
3. Principles of Navigation : Capt. T.K. Joseph and Capt. S.S.S. Rewari
4. Principles and Practice of Navigation : A. Frost
5. Admiralty Manual of Navigation Vol:I & II : HMSO
6. Nicholls Concise Guide Vol:I & II : Brown and Ferguson

SHIP OPERATION TECHNOLOGY PAPER – III

Course Code: BNS – 502

Marks:100

THEORY

SECTION : A – CARGO WORK

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Study of IMO codes and guidelines for the carriage of dangerous goods, timber, chemicals in bulks, liquefied gases in bulk, grain and bulk cargoes.		
02.	Detailed study of stowage and securing of various types of cargoes taking into account safety of ships and cargoes.		
03.	Cargo handling gear, designs and strength parameter, special requirements for handling of bulk cargoes and containers.		
04.	Principles involving the carriage of oil, chemicals and gases in bulk. Procedure to follow at tanker terminals. Detail study of tanker terminal codes for handling of petroleum products, bulk liquid chemicals and liquefied gases. Avoidance of accidental pollution's and precautions to be taken.		
05.	Knowledge of contents of International safety guide for oil tankers and terminals. Study of Tankers with respect to : Types of pumps, valves, pipeline systems, Ullageing, interface, cargo calculation. Operations of loading, discharging, ballasting, deballasting, inerting, tankwishing including COW, gasfreering.		

	Flammability diagram. Instruments for use of Oxygen and Hydrocarbon analysers. Man entry procedures. Rescue teams. Control of Oilspill.		
06.	Study of Bulk carriers with respect to : Loading, discharging, ballasting, deballasting operations. Precautions to be taken for high density cargoes, grain and concentrates.		
07.	Calculations relating to above topics.		

SECTION : B – MARINE COMMUNICATION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Basic knowledge of the various components of a shipboard GMDSS station.		
02.	Communication procedures under GMDSS in Distress & Safety situations in accordance with regulations contained in SOLAS, ITU and other publications		

PRACTICAL

MARINE COMMUNICATION

IMO NO		Teaching Methods	Teaching Material
01.	To send and receive morse code by flash lamp upto six words per minute		
02.	Knowledge of operation of radio equipment to be carried and used in a lifeboat & life raft. (EPIRB, SART, etc.)		
03.	Basic commercial working & logbook procedures using the simulator.		

BOOKS RECOMMENDED FOR REFERENCE

1. Cargo Work : Kemp and Young
2. Seamanship and Cargo Work : Capt. J. Dinger
3. Cargo Work : Capt. L.G. taylor
4. Stowage of Cargo Work : O.O. Thomas
5. Grain Rules : IMO
6. Code of Safe practice for Bulk Cargo : IMO
7. International Bulk Chemicals Code : IMO
8. I.M.D.G Code Consolidated edition 1988 : IMO
9. MARPOL 73/78 Consolidated Edition : IMO
10. Load Line Convention 1966 : IMO
11. Guide lines for Tank Washing with Crude Oil : ICS
12. The Chemistry of Oil Tankers Fires and Inert Gas System : Capt. G.S. Heridia
13. Tanker Handbook for Officers : Capt. C. Baptist
14. Tanker Practice : G.A.B. King
15. Tanker Practice : Rutherford

16. International Safety Guide for Oil Tankers and Terminals (ISGOTT) : ICS, OCIMF, IAPH
17. Amendments to SOLAS Convention Manual for Maritime Mobile Communication and Maritime Mobile Satellite Communication : ITU
18. International Volume of Radio Signals : HMSO
19. International Code of Signals : IMO
20. GMDSS for GOC : Clifford Merchant

NAVAL ARCHITECTURE PAPER - III
Course Code: BNS – 503

Marks:100

SECTION: A – SHIP STABILITY

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Use of Simpson's Rules for the computation of areas, second momet of areas, volumes, moments of volumes and centroids, Centre of pressure for regular shapes and parabolic shapes, when given horizontal or vertical ordinates.		
02.	Derivation of the formulae for TPC, FWA, BM (Transverse), MCTC, Angle of Loll, Virtual loss of GM due to free surface, Virtual loss of GM on dry docking. List with zero GM, Wall sided formula and Attwood formula.		
03.	Stability at moderate and large angles of heel. Use of the wall-sided formula		
04.	Effect of beam and freeboard on stability		
05.	Dynamical Stability – calculation of same by the GZ curve		
06.	Stability and trim when dry-docking or grounding		
07.	Theory of rolling. Synchronism		
08.	The danger to a ship at the angle of loll. Ballasting sequence to rectify same.		
09.	Dangers to a ship with a heavy list. Dangers associated with deck cargoes including timer preventive and corrective actions to take.		
10.	Bilging of compartment. Permeability of a compartment. Calculation on bilging and flooding of a compartment, symmetrical about center line anywhere along the ship's length for a box-shaped vessel given center MCTC.		
11.	The Inclining Experiment		
12.	Shearing Forces and Bending Moment. The ship as a box girder. The calculation, and graphical representation, of the SF and BM for box-shaped vessel, on even keel, under various conditions of load		
13.	Modern methods of determining the effect of different conditions of load and ballast on the ships structure and stability – Loadicator.		

14.	Calculations based on the foregoing and on the syllabi of the first and second years.		

SECTION : B – SHIP CONSTRUCTION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Properties of steel, aluminium and other construction materials used for shipbuilding. Effect of fire, heat, shock etc. on these materials		
02.	Types of ships. General ideas on strength and construction. Midship sections of specialized carriers – Passenger ships, RoLASH, Refrigerated cargo, LNG, LPG, Chemicals etc.		
03.	An out-line knowledge of shipyard practice and procedure including drawing office methods, place and section marking, process control and prefabrication		
04.	Methods used in welding of steel ships. Welding of ferrous and non-ferrous metals as practiced in Shipyards. Testing and inspection of welds. Types of joints and edge preparations. Stresses set up due to welding. Stress relieving		
05.	Classification Societies and their functions. Cargo Ship Construction Rules. An outline knowledge of Tonnage Regulations		
06.	Load Line Regulations. Assignment of freeboard. Subdivisional Load Lines on passengers ships.		
07.	Structural fire protection on Passenger and Cargo ships		
08.	Knowledge of application of floodable length curves. Factor of subdivision. Criterion of service numeral. Permissible length affecting hull division on passenger ships.		

BOOKS RECOMMENDED FOR REFERENCE

1. Merchant Ship Construction (1985 Ed.) : T.A. Taylor
2. Ship Construction (1988 Ed.) : Dr. J. Eyres
3. Ship Construction : Kemp and Young
4. (i) Load line (ii) Passenger Ship Construction (iii) Cargo Ship Construction
   (iv) Passenger Ship Construction : Statutory Regulation
5. Ship Stability (Vol:I, II & III) : Capt. H. Subraaniam
6. Problems on MV Hindship : Capt. Joseph and Capt. Rewari
7. Notes on Stability : Kemp and Young
8. Ship Stability for Masters and Mates : D.R. Derret
9. Reed's Ship Construction for Marine Students : E.A. Stokoe

B. Sc. Nautical Science Syllabus

MARITIME LAW

Course Code: BNS – 504

Marks:100

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	**Concept of Law-Civil, Criminal Law, Public Law, public and Private International Law.**		
02.	**Indian contract Act with reference to following:** Agreement, Offer and Acceptance, consideration, consent, capacity to contract, valid void and voidable contracts, quasi contract, breach of contract, remedies for breach, discharge of contract, agency bailment.		
03.	**Scope of Maritime Law-** Sources, Subjects and objects. Continental Shelf, Exclusive Economic Zone, Sea Bed, Admiralty Jurisdiction International aspects of Registration Ship building contracts and mortgage. Nationality of ships, flags of convenience & flag discrimination.		
04.	International Maritime Organisation- Its Structure, Objects, & Functions.		
05.	**Indian Merchant Shipping Act, 1958 in general with special reference to;** a) Definitions. Section 3. b) Registration of Indian Ships. Sections 20 to 74. c) Seamen & Apprentices. Sections 88 to 218. d) Limitation and Liability. Sections 352 to 352 F. e) Investigation and Inquires. Section 357 to 389.		
06.	**Contract of affreightment:** a) General aspects of Carriage of Goods by Sea Act, 1925. b) The Indian Multimodal Transport of Goods Act, 1993. c) Hague Visby Rules; Hamburg Rules. d) Charter Party- Various Clauses and their Interpretations		
07.	**Marine Insurance Act-** Insurable interest in a policy, difference between marine insurance policies and other policies, different types of marine insurance policies, perils of sea, claims. Settlement of claims.		
08.	Legal remedies maritime liens, at common law, general legal remedies as given in specific relief act. Writs injunction Indian Arbitration and Conciliation Act, 1996.		

BOOKS RECOMMENDED FOR REFERENCE

1. Merchant Shipping Act, 1958 : Govt. of India
2. The Indian Multimodal Transport of Goods Act, 1993 : Govt. of India
3. Carriage of Goods by Sea Act, 1925 : Govt. of India

4. Marine Insurance Act, 1963 : Govt. of India
5. The Arbitration and Conciliation Act, 1996 : Govt. of India
6. S.T.C.W. Convention, 1978 : I.M.O
7. The Indian Contract Act, 1879 : I.M.O
8. Relevant Shipping Manuals, conventions & Rules : I.M.O
9. Hague / Visby Rules, Hamburg Rules
10. Charter Parties : MScrutton
11. Indian Contract Act : Actar Singh
12. Maritime Law of India : Gopalan Nair, Editor
13. Shipping Law : Charley & Giles
14. Legal Regime of Merchant Shipping : Dr. Nagendra Singh
15. Limitation of Liability of Shipowners : Khodie Narmada
16. Maritime Liens : Dr. Thomas
17. Carriage of Goods by Sea : Mitra
18. Business & Law for the Shipmaster : F.N. Hopkins
19. Shipping Law : Grime R.
20. Law of Carriage of Goods : Avatar Singh
21. Law of Arbitration : Avatar Singh

ENVIRONMENTAL SCIENCE PAPER - III

Course Code: BNS – 505

Marks:100

SECTION: A – METEOROLOGY & OCEANORAPHY

IMO NO	THEORY	Teaching Methods	Teaching Material
1.	**Air Masses and Fronts:** **Air Masses :-** Basic concepts, Factors governing development & properties; classification; Convergence & Divergance **Fronts :-** Types; Associated weather, Frontal Depressions – Origin, Life and movement; Forecasting Techniques. Non-frontal Depressions.		
2.	**Tropical Revolving Storms :** Characteristic areas & Nomenclature; Origin, Structure & moements; associated weather; Forecasting Techniques – Past & Present; Cyclone Tracking & warning bulletins for merchant ships under international conventions; Practical rules of navigation for manoeuvring in the vicinity of a T.R.S.		

3.	**Meteorological Analysis & Weather Forecasting :** Sources of Meteoroloical data; principles of weather analysis; Weather forecasting; Principles & Practices, Macro, Meso & Micro level forecasting.		
4.	Meteorological & Reporting Systems : Voluntary observing fleet under I.M.D.; type & nature of information collected: Ship's Weather Code; weather reporting from ships and its significance in weather forecasting. International system of weather reporting		
5.	Voyage Planning & Weather Routing of ships : Basic considerations in Voyage Planning; selection and use of data. Weather Routing; Basic parameters; least time track and ship's performance curves.		

SECTION: B – ENVIRONMENTAL PROTECTION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Environmental Pollution; Basic causes; Common pollutants		
02.	International convention on prevention of pollution by Marine Environment 1973/ 78 (MARPOL); Pollution by oil, chemicals, hazardous substances, garbage and sewage. Pollution by micro-organisms in ballast water; measures for prevention.		
03.	Atmospheric pollution by marine transportation		
04.	Amendments against marine pollution		
05.	Liability against marine pollution		

PRACTICAL

IMO NO		Teaching Methods	Teaching Material
01.	Facsimile weather charts – interpretation of information contained therein		
02.	Exercise on the selection ocean rules on the basis of prognostic surface weather charts		
03.	Application of rules of Navigation when near or facing tropical storms – few exercises.		
04.	Principles of working and use of meteorological instruments		

BOOKS RECOMMENDED

8. Weather analysis & forecasting Vol. - I : S. Petterson
9. Weather analysis & forecasting Vol. - II : S. Petterson
10. Tropical Meteorology : H. Reehi
11. Principles of Meteorological Analysis : W. J. Saucier
12. Marine Meteorology : Capt. H. Subramaniam
13. Meteorology for Mariners : HMSO
14. Marine Observer's Hand Book : HMSO

8. Atmosphere, weather & cluimate : R. G. Barry & R. J. Chorley
15. Ship's code : I. M. D
16. Dynamic & physical meteorology : Haltiner & Martin
17. General Meteorology : H. R. Byers
18. Numerical Weather Analysis & Predication : P. D. Thompson
19. Atlantic Hurricanes : Gord E. Dunn
20. An Introduction to Dynamic Meteorology : J. R. Holten
21. Atmospheric science an Introduction Survey : P. E. Hobbs
22. Forecasting Manuals : I. M. D
23. Numerical Predication : Haltiner J. H. & Williams R. T.
24. Marpol 73/78 with all amendments : I. M. O

MARINE COMMUNICATION & GMDSS

Course Code: BNS – 591

Max. Marks: 100

IMO NO		Teaching Methods	Teaching Material
01.	Meaning of bunting, halyard, at the dip, close up, half mast, hoist, fly, tackline Courtesy flag, ship's numbers, jack flag, quarantine flag, pilot flag, Blue Peter. Location on a ship of Jack staff. Ensign staff, Gaff, Triatic stay, Foremast Yardarm, Main mast head. What flags are hoisted from these part of ship and when Types of ensigns. Penalty for not using or wrongly using an ensign.		
02.	Introduction and use of Radio Communication Equipment on board ship for distress and safety selection of suitable frequencies.		
03.	Radio Regulations relating to maritime Services including maritime frequency allocation.		
04.	Satellite Communication and Alerting systems – Equipment on board and shore. Methods adopted.		
05.	Global Maritime Distress and safety System – Principles and actual applications		
06.	World Wide Navigational Warning System – India's role as a Co-ordinator for area 8.		
07.	Meteorological Broadcast – Routine weather messages and storm warnings		
08.	Search and Rescue Communications		
09.	Basic knowledge of the various components of a shipboard GMDSS station.		
10.	Communication procedures under GMDSS in Distress & Safety situations in accordance with regulations contained in SOLAS, ITU and other publications		

e) Recognition of national flags of all countries f) Recognition of House flags and funnels of Indian Shipping Companies. g) Recognition of flags denoting numbers and flags used as substitutes h) How to bend on or unbend a flag from halyard. Breaking a flag at close up. i) Flag hoisting practice at colours and sunset j) Morse signaling with Aldis lamp on mains and battery. k) Morse signaling with Daylight signaling Apparatus l) To send and receive morse code by flash lamp upto six words per minute. m) Knowledge of operation of radio equipment to be carried and used in a lifeboat & life raft. (EPIRB, SART, etc.) n) Basic commercial working & logbook procedures using the simulator.		

WEST BENGAL UNIVERSITY OF TECHNOLOGY

(KOLKATA)

SYLLABUS

FOR

SIXTH SEMESTER B. SC. (NAUTICAL SCIENCE)

EFFECTIVE FROM - 2005-2006

B. Sc. Nautical Science Syllabus

SIXTH SEMESTER

PRINCIPLES OF NAVIGATION PAPER – IV

Course Code: BNS – 601

Marks:100

THEORY

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	The construction of the magnetic compass and binnacle. The method of determination and compensation by means of components of the effects of a ship's magnetic field on the magnetic compass. The approximate coefficient A, B, C, D and E. Conditions which might produce coefficients A and E. Analysis of a table of deviation to obtain appropriate coefficients. Method of obtaining a table of deviations. Calculations on the above.		
02.	General principles of compass corrections and the method of correction for coefficients B, C, and D. Heeling error and its cause, effect and method of correction. Siting of compasses with reference to the proximity of magnetic material and electrical appliances. Care and maintenance of liquid compasses. Calculations on the above.		
03.	The properties of the free gyroscope. The relationship between applied force and precession. The effect of earth's rotation on a free gyroscope. Drift, tilt and damping. Errors associated with gyro compasses including latitude, course and speed correction, rolling error and how it is minimized. The principal parts of gyro compass, follow up and repeater systems.		
04.	Hyperbolic position fixing systems : Decca Navigator : Description of the system. Errors, reliability, limitations & accuracy of the system. Loran : Description of the system. Errors, accuracy and reliability of the system.		
05.	Satellite Navigation : General features of Navigational satellite. Orbits of Satellites. Full description of the Global Positioning System, (GPS and DGPS).		
06.	Sonar Aids : Echo Sounder : Principle and working. Operational controls. Choice of site for echo sounder transducers. Errors causing display of faulty or unreliable sounding. Doppler Log : Description of the system. Errors and their remedies. Berthing aids : Brief description of systems using sound propagation and systems using radiowaves propagation.		

07.	Radar : Characteristics of Radar set – its limitations. Errors and accuracy. Anamolous propogation. Spurious echoes. Influence of weather. Various types of displays. Radar logbook. Use of radar for navigation and collision avoidance, knowledge of ARPA Radar. Racon,. Ramark Beasons.		

PRACTICAL

IMO NO		Teaching Methods	Teaching Material
01.	**Gyro-compass:** Familiarisation with various types of Gyro-compasses used on Merchant ships. Explain procedure starting and stopping and routine maintenance.		
02.	**Echo Sounder :** To take soundings using both visuals and graphic types. (Actual instrument or simultator).		
03.	**Radar :** Practical adjustment of operational controls. To carry out performance check. Use of performance monitor. To take range and bearing of targets. To identify land objects on the Navigation Chart using radar observations. Reflection Plotter evaluation of risk of collision using relative & true plotting techniques and ARPA Radar.		
04.	**Decca Navigation :** To take readings on the Decca Navigator, receiver/ Simulator and determination of the Ship's position. Use of Decca Chart.		
05.	**GPS :** Familiarity with usage of GPS set.		

BOOKS RECOMMENDED FOR REFERENCE

1. Ship's Magnetism and Magnetic Compass : F.G. Merrifield
2. Compass Work : Kemp and Young
3. Radar at Sea : G.I. Sonnenberg
4. Ship Borne Radar : Capt. H. subramaniam
5. Radar and ARPA Manual : A.G. Bole and W.O. Dineley
6. Ships Compass : Klinkert and Grant
7. Magnetic Compass Deviation and Correction : W. Denne
8. Gyro Compass for ship's officers : A. Frost
9. Radar observer's handbook : W. Burger
10. Marine Electronic Navigation : S.F. Appleyard
11. Electronic Aids to Navigation Position Fixing : L. Tetley and D. Calcutt

SHIP OPERATION TECHNOLOGY PAPER – IV

Course Code: BNS – 602

Marks:100

THEORY

SECTION : A – SEAMANSHIP & WATCHKEEPING

B. Sc. Nautical Science Syllabus

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Watchkeeping at Sea, at anchor & in port. Taking over, keeping and handing over of a watch.		
02.	Preparation for proceeding to sea, making port and entering harbours.		
03.	Berthing alongside and leaving quays under various conditions of wind & tide.		
04.	Knowledge of manoeuvring trails, measured mile, angle of heel when turning, stopping distance, turning circles, advance, etc. Shallow water effect, Interaction. Turning ship short round, emergency maneuvers, Man overboard.		
05.	Anchor work – different types of anchors, their advantages/ disadvantages, cables & there care, Anchoring to single anchor. Use of 2nd anchor – when, why and how. Mooring – Standing Moor – Running Moor.		
06.	Thorough knowledge of ropes and wires. Their SWL, Proof Load & Breaking strengths, Knots, bends, hitches and splices in common use. Purchases & tackle – power gained.		
07.	Muster lists and all duties connected with the same. Use & care of Life Saving and Fire Fighting Appliances.		
08.	Life Boat/ Life raft – Statutory requirements, handling them in an emergency. Precautions in manoeuvring for launching of boats or life rafts in bad weather. Methods of taking on board survivors from lifeboats & life rafts.		
09.	Prevention of fire at sea & in port. Oxidation, flashpoint auto ignition temperature, and spontaneous combustion. Methods used to prevent the spread of fire. Action to be taken.		
10.	Damage control. Action to be taken following collision and grounding.		
11.	Steps to be taken when disabled & in distress. Preservation of passengers and crew in an event emergency. Abandoning ship-survival procedure.		
12.	Assisting a ship or aircraft in distress use of MERSAR manual.		
13.	Management of ship in heavy weather – use of oil.		
14.	Elementary ideas on Towing and being towed.		
15.	Precautions to be observed to prevent pollution in port & on the high seas.		

SECTION : B – MAINTENANCE

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Inspection and maintenance of ship and equipment. Items to be covered include Hull, Bulkheads, DBs, Deep and Peek tanks, bulges, pipe lines, rudders, anchor and cables. Davits, safety equipment, derricks and other cargo gear, Navigation lights. A practical knowledge of siting and screenary of ships navigational flights.		
02.	Treatment of steel surface – Removal of rust and scale – Primers – Modern paints. Dry Docking-general procedures – Precautions to be observed – Distribution of weights. Maintenance of Crew accommodation. Methods of post control. Fumigation of holds and living spaces. Safe guards in applying various methods.		
03.	Survey and classification of ships with reference to safety equipment and safety construction certificates with particular attention to maintenance aspect.		

B. Sc. Nautical Science Syllabus

PRACTICAL

SEAMANSHIP & WATCHKEEPING

IMO NO		Teaching Methods	Teaching Material
01.	To find quantity of liquid in a tank using calibration tables. Handling of boat under Oars. Coming alongside and getting away. Picking up a man overboard.		
02.	To take rope & chain stoppers. To reeve a 3 fold purchase and gun tackle.		
03.	Overhauling of blocks		
04.	Demonstrate to cadets : taking drafts to transfer rope from mooring winch to bollards and making fast; removing of rust by chipping, preparation of surface, use of proper primers, brush painting, To make a stowage plan and cargo distribution together with working out of load densities. The use of explosimeter to determine the percentage of gas in a tank.		
05.	Use of various types of fire extinguishers in the event of fire. To recharge various types of fire extinguishers. Use of smoke helmet, and breathing apparatus.		
06.	Identification and familiarization with the documents and certificates carried on board – Brief contents and their validity.		

BOOKS RECOMMENDED FOR REFERENCE

1. Theory and Practice of Seamanship : G. Danton
2. Seamanship Notes : Kemp and Young
3. Seamanship and Cargo Work : Capt. J. Dinger
4. Nicholl's Seamanship and Nautical Knowledge : A.N. Cockroft
5. Shipboard Operations : H.I. lavery

VOYAGE PLANNING & COLLOSION PREVENTION PAPER – III
Course Code: BNS – 603

B. Sc. Nautical Science Syllabus

Marks:100

THEORY

SECTION: A – VOYAGE PLANNING

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	To find the time and height of HW and LW at standard ports and at secondary ports by Tidal differences. To find the time at which the tide reaches a specified height or the heights of the tide at a given time and hence the correction to be applied to soundings or charted heights of shore objects.		
02.	A systematic knowledge and use of the contents of the following documents in relation to Safety of Navigation Sailing Directions List of Light & Fog Signals List of Radio Signals Ocean Passages of the world Notices to Mariners Guide to Port Entry		
03.	Selection of ocean routes. Shore-based Weather Routing. Planning & executing a coastal passage. Navigation in pilotage waters. Approaching and passing through a Traffic Separation Scheme.		

SECTION : B – COLLISION PREVENTION

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Thorough Knowledge of all the Rules, Annexes of International Regulations for prevention of collision and IALA buoyage systems.		
02.	Radar plotting exercises True Plot Relative Plot Determining bow pass distance Revision of radar plotting syllabus done in second year Deciding action for collision avoidance taking into consideration the 'Rules of the Road'.		

PRACTICAL

VOYAGE PLANNING

IMO NO		Teaching Methods	Teaching Material
01.	Practicals of first Year and second Year pertaining to Position fixing by various methods, current & leeway, running fix and three point bearing, and the use of hyperbolic charts, to a higher degree.		
02.	Demonstration of the ability to plan a passage taking into consideration important factors such as depth of water, distance of dangers, current, traffic separation		

	schemes, navigations aids available etc.		

COLLISION PREVENTION

IMO NO		Teaching Methods	Teaching Material
01.	The students will be required to identify various collision situations by day and by night. Practicals to be held using a Magnetic Board, Wooden models, or any other aids to simulate such conditions.		
02.	Candidates will be required to deal with each collision situation broadly under the heading 'recognition', 'responsibility', ' action', 'appropriate sound signal' and 'any ordinary practice of seaman'		
03.	Recognition of various buoys & marks under IALA system and appropriate actions required under the Rules.		
04.	Collision situations in restricted visibility with or without Radar Statutory obligations under both circumstances.		

BOOKS RECOMMENDED FOR REFERENCE

1. Chart Work : Capt. S.K. Puri
2. Rule of the Road : Bhandarkar Publications
3. BA Chart 5011 : HMSO
4. Ship Borne Radar chapters on plotting : Capt. H. Subramaniam
5. Voyage Planning and Chart Work : Capt. M.V. Naik and Capt. Varty
6. International Light, shape, sound signals : D.A. Moore
7. A Guide to collision avoidance : A.N. Cockroft
8. Chart Work : Capt. S.S. Choudhury
9. Modern Chart Work : Capt. W.H. Squair

SHIPPING MANAGEMENT

Course Code: BNS – 604

Marks:100

SECTION: A – MARINE MANAGEMENT

IMO	THEORY	Teaching Methods	Teaching Material

NO			
01.	Managing & Managers. Organization and the need for management; the management process, types of managers, management level and skills, managerial roles, the challenge of management		
02.	The evolution of management theory : Why study management theory ? The classical management theories; the behavioural school, the quantitative school – operations research and management scjence; the evolution of management theory.		
03.	The external environment of organization : The external environment and its importance; elements of the direct-action environment; elements of the indirect-action environment; theories of total organization environments, managing the total environment.		
04.	Planning and strategic management : Planning – an overview; the formal planning process; the evolution of the concept of strategy		
05.	Social responsibility and ethics : The changing concept of social responsibilities; the shift to ethics; the tools of ethics; the challege of relativism.		
06.	Strategy implementation : Matching strategy implementation to strategy; matching structure and strategy; institutionalizing strategy.		
07.	Decision making : Problem and opportunity finding; the nature of managerial decision making; the rational model of decision making; challenges to the rational model; improving the effectiveness of decision making and problem solving.		
08.	Planning and decision-making tools & techniques : The management science approach; the management science process; planning for the future – forecasting; planning for the future – scheduling; planning to meet goals with certainty; planning to meet goals with uncertainty.		
09.	Organisational structure, coordination, and design : Organisational structure; types of organizational structures, coordination, organizational design.		
10.	Authority, delegation and decentralization : Authority, Power and influence; line and staff authority; delegation; job design; decentralization		
11.	Human resource management: The HRM process – a traditional view; human resource planning; recruitment; selection; orientation or socialization; training and development; performance appraisal; promotions, transfer, demotions, and separations; HRM and strategy.		
12.	Managing organizational change and innovation : Why planned change is needed ? A model of the change process; types of planned change; organizational development; managing creativity and innovation.		
13.	Motivation, performance and job satisfaction : Theories of motivation – an overview; content theories of motivation; process theories for motivation; reinforcement theory; a system view of motivation in organizations.		
14.	Leadership Defining leadership : the trait approach of leadership; the behavioral approach to leadership, contingency approaches to leadership; the future of leadership theory.		
15.	Groups and committees : Types of groups; characteristic of groups; problem solving in groups; making formal groups effective.		
16.	Communication and negotiation : The importance of communication; interpersonal communication; barriers to effective interpersonal communication; communication in organizations; using communication skills – negotiating to manage conflicts.		

17.	Effective control : The meaning of control; types of control methods; designing control systems; financial controls; budgetary control methods		
18.	Operations management : The nature of operations; the importance of operations management, designing operations systems; operational planning and control decisions; quality control.		
19.	Information systems : Information and control; management information systems; designing a computer-based MIS; implementing a computer based-MIS; end-user computing; the impact of computers and MIS on managers and organizations.		

SECTION : B – COMMERCIAL MANAGEMENT

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	International Trade and Shipping : Seaborne trade of the workd composition and direction of cargoes – different types of ships which carry them – Technological developments – Role of Shipping on national economic development.		
02.	Basic Structure of Shipping Industry : Types of Shipping services – Liner and Tramp – Role of Intermediaries in shipping business: Freight brokers, Clearing and Forwarding Agents – Stevedores – Shipbrokers, Bunker and Stores suppliers etc. Shipping Agencies.		
03.	Liner Trades – Characteristics – Liner Conferences – How Freight rates are fixed Components of Liner Freight – Non-Conference lines – competition. Procedures of Shipping cargoes and related documentation : Mate's Receipt. Bill of Lading. Unitload systems – containerization and multimodal transport.		
04.	Tramp Trades – Chartering – different types of chartering ships – their relevance to trades – Procedures and documentation relating chartering – Charter markets of the world – How freight/ charterhire is fixed.		
05.	Organization of shipping company – Manpower planning – Business and cargo management – Statutory regulations to be complied with like Foreign Exchange Regulation.		
06.	Role of ports : Port locations – Functions and range services – Financial aspects of utilization and cargo handling. India's ports, their organization and administration. Modernization and development of ports.		
07.	Role of Customs : Customs Act and documents relating to customs relating to ship operations and trade		
08.	India Shipping Development : India's Merchant Fleet – Role of Government – Maritime Administration in India – India's Shipping Policy.		
09.	Maritime Frauds : Safeguards to be taken to prevent frauds with special reference to shipping industry, operators and seafaring personnel.		
10.	Role of International Organisation : IMF, World Bank, IMO, UNCTAD, WTO.		

BOOKS RECOMMENDED FOR REFERENCE

1. Management : Stoner and Freeman
2. Basic Free Management : Dr. A.V. Athalye
3. The Practice of Management : Drucher P.
4. People in organisation, an introduction to organisation behaviour : Mitchell and Terence P.

5. Consumer Behaviour, Basic findings and Managerial implication : Zaltman G. and Wallendrof A.
6. Mathematics of investment : Hart W.L.
7. Theory and practice of Management information system : Burch, Strater, Grudnestei
8. A Concept of Corporate planning : Pussel L. and Ackoff
9. IACOCCA – An autobiography : Lee Iacocca
10. An introduction to Financial Management : Solomon and Pringle
11. Manpower Management : Dwivedi R.S.
12. Industrial Relations to India's Developing Economy : N.N. Chattejee
13. An introduction Database System : Dale C.J.
14. Monetary planning for India : Capt. Suraj B.
15. Economics of Shipping and other papers : Dr. S.N. Sanklecha
16. International Maritime fraud : Ellen and Campbell
17. Elements of Shipping : Alan Branch
18. Containerisation era in India : Dr. K.V. Hariharan

MARINE ENGINEERING & CONTROL SYSTEM PAPER - III

Course Code: BNS – 605

Marks:100

THEORY

SECTION: A – MARINE ENGINEERING

IMO NO	THEORY	Teaching Methods	Teaching Material
1.	**AUXILIARIES** a) Fuels : Different types and properties. Fuel storage & supply on board the ship b) Turbines : Impulse and reaction turbine, gas, turbines, steam turbine operations & care. Turbines as prime movers for various duties including as cargo pumping operations of tankers. c) Propeller & main shifting : Types of propellers, fixed pitched & variable pitch propellers. Pitch, pitch angle, real and apparent slip, propeller efficiency, calculations. Shifting tailend shaft, thrust block, intermediate shaft, alignment. d) Deck Machinery : Cargo winch, windlass, lifeboat winch. Hydraulic, Pneumatic electric drives. Safety features. e) Pollution control : Sewage disposal, methods, limits, regulations, Bilge oil water separator, regulations		
2.	**Main propulsion units (IC engine & others)** **A) " IC engine"** a) Process exhausting, scavenging and supercharging. Scavenge fires. b) Lubricating oil, jacket (and other) cooling water systems. Types of lubricating oils for different duties. Simple CW, L.O and F.O flow circuits		

	for large diesel engine. Reasons and method of chemical treatment of CW system. Testing of jacket cooling water. c) Operations of IC engine as main propulsion engine. Warming up, starting manoeuvring, reversing and full power running of the main engine. Limitations and care required on IC engine during manoeuvring and at full power. d) Selection criterion of IC engines, power weight ratio, specific fuel consumption, indicated power, brake power, shaft power delivered power, thrust power, effective power. Various efficiencies, calculations. Maximum continuous rating (MCR). Calculation of fuel consumption, economic speed. Heat balance, various losses and calculations. **B) "Other propulsion units"** Steam turbine, gas turbine as main propulsion units. Advantages and disadvantages. Manoevring.		

SECTION: B – AUTOMATION & CONTROL ENGINEERING

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Introduction, growth in shipboard automation, understanding terminology. Sensors , measuring elements for temperature, pressure, level, flow, etc. Transmitter and actuators.		
02.	Automatic control systems, open loop, closed loop control system, general principles. Controllers and proportional controller. Pneumatic, hydraulic, electric, electronic control systems. Applications in various shipboard operations.		
03.	Bridge control on main propulsion. Manoeuvring aids – CP. Propeller, bow thruster. Care and prepautions.		
04.	Trim indicator, heel indicator, draft gauge, load and stress indicators.		
05.	Liquid cargo loading, storage an discharge operations. Monitoring. Remote level gauges. Type of remote control valves used on board ships. Remote control operation of hatch covers. Remote operation for loading, discharging and ballasting operations.		
06.	Information display, data logging, alarm systems. Testing and maintenance		

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SECTION: C – SAFETY ARRANGEMENTS

IMO NO	THEORY	Teaching Methods	Teaching Material
01.	Fire detectors, smoke, heat, flame etc. Fire alarm circuits		
02.	Fire Fighting systems. Fixed fire fighting installations for engine room, accommodation and cargo holds, CO_2 flooding, high pressure water system, water sprinkler system, bulk dry powder and foam systems.		
03.	Inert gas for cargo. Inert gas production, generation from boiler fuel gas etc. Inert gas system plant. Use of O_2 analyzer, explosive meter, dragger pump and other portable measuring instruments.		
04.	Smoke helmets, breathing apparatus, fire suit and other safety equipments		
05.	Role of classification society I quality of construction, machinery and operations. Surveys and importance of same.		
06.	Lifeboat engine, emergency fire pump engine, lifeboat winch, operation and care.		

PRACTICAL

IMO NO		Teaching Methods	Teaching Material
01.	Familiarity with parts of internal combustion engine – medium and large size.		
02.	Familiarity with parts of pumps, compressor heat exchangers, valves fittings.		
03.	Assembly of certain engine components		
04.	Starting and running operations of motor boat engines, emergency fire pump engine.		
05.	Starting, running and care of centrifugal pumps and air compressor.		
06.	Simple turning operations on lathe machine		
07.	Use of instruments like portable O_2 analyser, explosimeter, dragger pump.		

BOOKS RECOMMENDED

1. General Engineering Knowledge for Marine Engineers : L. Jackson and T. Morton
2. Reeds Engineering Knowledge for Deck Officers : W. Embleton and T. Morton
3. Basic Electro Technology for Engineers
4. Marine Engineering Series – Marine Boilers : GTH Flanogan
5. Marine Engineering Series Diesel Engines : Wharton A.S.
6. Marine Auxiliary Machinery : D.W. Smith

7. Marine Electrical Practice : G.O. Watson
8. Instrumentation and Control for engineers
9. Fire fighting equipment and its uses on ship. Marine Engineering Vol:I
10. Principles and Practice of Marine Diesel Engineers : D.K. Sanya

SHIP OPERATION & SAFE WORKING PRACTICES

Course Code: BNS – 691

Max. Marks:100

01.	**Life Saving Appliances** Classification of ships for Life Saving Appliances. LSA requirements for cargo ships. Life Boat : Description of lifeboat. Construction and parts of lifeboat. Buoyancy tanks. Means of propulsion. Different classes of lifeboats used. Motor lifeboats, totally enclosed lifeboats, partially enclosed life boats. Determining the carrying capacity of a lifeboat. Equipment, rations and distress signals. Types of boat davits and their method of operation. Liferaft :- Inflatable and rigid. Construction and parts of liferaft. Fiferaft equipment, ration and distress signals. Repairing leaks and punctures. Getting into a liferaft. Inflatable chute. Life Buoy :- Description of a life jacket. Buoyant material used. The correct method of putting on a life jacket and jumping into water. Line throwing appliances : Description and use of the line throwing appliance. Safety, care and maintenance of life saving appliances.		
02.	**Fire Fighting Appliances** Fire hydrants and hoses. Types of connections. International shore connection. Types of nozzles. Description of portable fore extinguishers, various types and their suitability for different types of fires. Operation and refilling of fire extinguishers. Principle of fire extinguishing used each type. Safety devices : Fireman's outfit, Smoke helmet and Self Contained Breathing Apparatus. Safety lamps and their arrangement for prevention of sparks. Fire axe. Asbestos suit. Fixed smothering systems : Brief description of steam smothering system, carbon dioxide smothering system, Insert gas system, Flue gas system, Halon system, Foam smothering system for liquid fires, High expansion foam system. Safety, care and maintenance of all fire fighting appliances.		
03.	**Survival at sea:** Boat drills and musters. Action prior to, and after abandoning ship. Managing the craft and personnel in the craft. Handling of the craft. Landing signals. An outline knowledge of SOLAS requirements of LIFE SAVING APPLIENCES.		
04.	**FIRE PREVENTION AND FIRE FIGHTING:**		

	Causes of fire. The fire triangle. Principles of fire fighting. Types of fire and methods of extinguishing each type. Various methods of detection and fighting of fire. Causes of fires in tankers during various operations carried out by tankers and its prevention methods. Outline knowledge of SOLAS requirements on FFA		
05.	**SHIP MANOEUVRING** Effect of various factors on manoeuvring. Berthing and unberthing at quays and oil terminals. Management of ship in heavy weather. Precautions in manoeuvring for lunching of boats or life rafts in bad weather. Methods of taking on board survivers from life boats and life rafts.		
06.	Inspection and maintenance of ship and equipment. Items to be covered include Hull, Bulkheads, DBs, Deep and Peek tanks, bulges, pipe lines, rudders, anchor and cables. Davits, safety equipment, derricks and other cargo gear, Navigation lights. A practical knowledge of siting and screenary of ships navigational flights.		
07.	Treatment of steel surface – Removal of rust and scale – Primers – Modern paints. Dry Docking-general procedures – Precautions to be observed – Distribution of weights. Maintenance of Crew accommodation. Methods of post control. Fumigation of holds and living spaces. Safe guards in applying various methods.		
08.	Survey and classification of ships with reference to safety equipment and safety construction certificates with particular attention to maintenance aspect.		