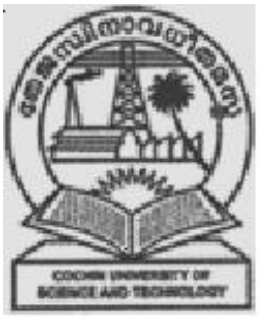
REGULATIONS, SCHEME & SYLLABUS

for

B.Tech Degree in Marine Engineering

(With effect from 2013 Admissions)



Kunjali Marakkar School of Marine Engineering

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
COCHIN – 682 022

REGULATIONS FOR B.TECH MARINE ENGINEERING DEGREE COURSE OFFERED IN KUNJALIMARAKKARSCHOOL OF MARINE ENGINEERING

The following regulations are made applicable to the B.Tech Marine Engineering programme offered by Kunjali Marakkar School of Marine Engineering with effect from the academic year 2013-2014.

1. Admission to the course:-

1.1 The candidate shall have passed the Higher Secondary (10+2) examinations conducted by the Board of Higher Secondary Examination, Govt.of Kerala or Examination of any other University/Board, with Mathematics, Physics and Chemistry as subjects or any other examination accepted as equivalent thereto by the Cochin University of Science and Technology (CUSAT).

1.2 The candidate shall have secured a minimum of 50% marks for mathematics, 60% marks for Mathematics, Physics and Chemistry put together in Higher Secondary (10+2) Examination and a minimum of 50% marks in English either in 10^{th} standard or in 12^{th}.

1.3. The candidates shall also satisfy the conditions regarding Age and Physical fitness as may be prescribed by University and Director General of Shipping.

1.4. The admission to the course shall be through the Common Admission Test conducted by the University.

2. Duration of the course:-

2.1 The duration of the B.Tech course in the University shall be eight semesters spanning over four academic years.

2.2 The first two semesters will be combined together as first year, and the remaining three years shall be split into 6 semesters.

2.3 The teaching programme for each semester shall consist of 17weeks and that for the first year will consist of 34 weeks.

2.4 Out of the 8 semesters, the 7^{th} semester shall be allotted for "Ship-in-Campus Training" and assessment of the training is done separately.

2.5 Examinations will be conducted at the end of the year/semester in subjects prescribed in the respective scheme of examinations.

3. Structure of the B. Tech programme

3.1 The programme of instruction will consist of the following:

i) a General (common) core programme comprising basic sciences, engineering sciences, technical arts and mathematics;
ii) an Engineering core programme introducing the student to the foundations of marine engineering;
iii) an Elective programme enabling the student to opt and undergo a set of courses of interest to him/ her;

iv) Professional practice including project, seminar and high-tech labs consisting of control systems, full mission engine room simulator, ship-in-campus and visits to shipyards etc.

v) Courses on Communication Skills, Environmental Studies and Professional Ethics.

3.2 The B. Tech. programme will have a curriculum and syllabi for the courses approved by the Academic Council of the University and Director General of Shipping.

3.3 The Course of study shall follow credit system and will be in accordance with the scheme, course content and syllabus prescribed. The total credit for the entire course shall be 200.

4. Eligibility for the degree:

4.1. No candidate shall be eligible for the B.Tech Degree in Marine Engineering unless he/she has undergone the prescribed course of study for a period not less than 4 academic years from the date of admission to the first semester and has passed the prescribed examinations in all the semesters.

4.2. The candidate shall complete all requirements for the degree within a period of 8 academic years from the date of admission to the first year.

5. Mode of Evaluation

5.1. The performance of the students will be evaluated based on continuous assessment and university examination. For theory courses, the continuous assessment and university examination will carry a maximum of 50 marks and 100 marks respectively. For practical courses, the continuous assessment and end semester examination will carry 50 percent weightage each.

5.1.1 Continuous Assessment: All sessional works shall be valued and marks shall be awarded on the basis of day-to-day work, periodic tests and regular assignments based on the scheme of evaluation as decided by the School Council.

The total sessional marks for theory and laboratory courses shall be made up of 50% for internal tests (minimum two tests), 40% for assignments/quizzes/seminars and 10% for attendance. However the teachers, depending upon the specific requirements of the subjects, can make changes in the distribution with the permission of the Director of the School.

Marks for attendance shall be awarded as follows:

% of attendance	marks awarded
96-100	5
91 -95	4
86-90	3
81 -85	2
75-80	1
below 75	0

5.1.2 A candidate shall be allowed to improve the continuous assessment marks in theory / laboratory courses subject to the following conditions:

a) During his/her regular course work of any semester, improvement of continuous

assessment marks of any previous semesters will not be permitted.

b) He /she shall repeat the theory / practical course only once and shall satisfy the minimum attendance requirement of 75 percent while repeating the course.

c) He / she shall not be allowed to repeat the course work of any semester if he/she has already secured a minimum of 60 percent marks for continuous assessment.

d) He / she shall not be allowed to repeat the course work of any subject of any semester of which he/she has already passed the semester examination in full.

5.2 **University Examination**:- There shall be University Examination at the end of every semester in the subjects as prescribed under the scheme of examination.

5. 3 To pass in a subject, a candidate has to score not less than 45% of the marks in the University examination and not less than 50% aggregate marks in the University examination and sessional marks, put together.

5.4 In subjects where there are no University examinations, a candidate has to score not less than 50% marks for a pass in that subject. In the case of laboratory courses, the candidate shall obtain a minimum of 50 percent marks for continuous assessment and end semester examination put together with a minimum of 50 percent marks for the end semester examination. Those who fail in the laboratory course shall appear in the end semester examination in the next available chance.

5.5. The question paper for the University examination will be set by an external examiner. The controller of examinations will make necessary arrangements for setting the question papers and valuation of answer books for the University examination.

5.6. The continuous assessment in laboratory course will be based on supervision of the student's work, their performance in viva-voce examinations and the quality of their work. The end semester examination for the laboratory courses shall be conducted internally with at least two faculty members as examiners.

5.7. In the case of project work, a committee consisting of the Project Coordinator (appointed by the Director of the School), project guide and at least one senior faculty member will carry out the assessment based on at least two interim reviews and a final review just before the submission of the project report.

5.8. The Viva-voce examination at the end of VIII Semester will be conducted by a panel of examiners consisting of the Director of the School or his/her nominee and one senior faculty of the School and one external expert.

6. Promotion to Higher Semesters

6.1 The candidate shall be eligible for promotion from one semester to the next semester only if :

a) he / she has secured a minimum of 75 % attendance,

b) he/she has registered for the University examination, and

c) his/her progress and conduct have been satisfactory

7. Attendance.

The rules followed for B.Tech Courses of CUSAT and D.G. Shipping will be applicable.

7.1 The percentage of attendance of a candidate for a semester shall be indicated by a letter code as given below.

Attendance	**Letter Code**

90% and above	H
75% and above but less than 90%	N
Less than 75%	L

7.2. A student whose attendance is less than 75% for a semester is not eligible to appear for the University examination.

7.3. The Vice-Chancellor shall have the power to condone shortage of attendance up to 5 percent on medical grounds on the recommendations of the Head of Department. However. such condonation for shortage of attendance shall be given only twice during the entire course.

8. Grading

8.1. Grades shall be awarded to the students in each course based on the total marks obtained in continuous assessment and the end semester examination. The grading pattern shall be as follows:

Marks obtained (Percentage)	Grade	Grade points
90- 100	S	10
80-89	A	9
70-79	B	8
60-69	C	7
50-59	D	6
< 50	F	0

Decimal percentages shall be rounded to the next higher number if it is greater than or equal to 0.5.

8.2. A student is considered to have credited a course or earned credits in respect of a course if he/she secures a grade other than F for that course.

8.3. Grade Point Average.

The academic performance of a student in a semester is indicated by the Semester Grade Point Average (SGPA).

$$SGPA = \frac{G1C1 + G2C2 + G3C3 + \text{----------} GnCn}{C1 + C2 + C3 + \text{----------} Cn}$$

Where 'G' refers to the grade point and 'C' refers to the credit value of corresponding course undergone by the student.

8.4. Grade Card

The Grade Card issued at the end of the semester to each student by the Controller of Examinations, will contain the following:

a) the code, title, number of credits of each course registered in the semester,

b) the letter grade obtained,

c) the attendance code,
d) the total number of credits earned by the student upto the end of that semester and
e) SGPA & CGPA.

8.5. Classification based on CGPA is as follows:
CGPA 8 and above: First Class with distinction
CGPA 6.5 and above, but less than 8: First Class
CGPA 6 and above, but less than 6.5: Second Class.

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SCHEME OF EXAMINATION

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
COCHIN-22

B.Tech Degree Course in MARINE ENGINEERING
SCHEME OF EXAMINATION

Course No.	Subject	Hours per week				Max. Marks		Total
		L	T	P	C	Internal	University	
Combined I & II Semesters								
MRE 1101	Engineering Mathematics - I	2			3	50	100	150
MRE 1102	Engineering Mathematics - II	2			3	50	100	150
MRE 1103	Engineering Physics	2			3	50	100	150
MRE 1104	Engineering Chemistry	2			3	50	100	150
MRE 1105	Engineering Mechanics	3	1		4	50	100	150
MRE 1106	Engineering Graphics	1		3	4	50	100	150
MRE 1107	Fundamentals of Engineering - I	4			4	50	100	150
MRE 1108	Fundamentals of Engineering-II	4			4	50	100	150
MRE 1109	Computer fundamentals	3			3	50	100	150
MRE 1110	Environmental Studies and Technical communication	2*			3	50	100	150
MRE 1111	Computer Programming Lab			2	2	100	-	100
MRE 1112	Workshop Practice-I (Electrical and Mechanical)			4	4	100	-	100
MRE 1113	Language Laboratory			1	1	100	-	100
	Total	**25**	**1**	**10**	**41**			
* 1 hour / week each for Environmental Studies and Technical Communication.								
Semester III								
MRE 1301	Engineering Mathematics - III	3	1		3	50	100	150
MRE 1302	Electrical technology	5	1		4	50	100	150
MRE 1303	Workshop Technology	4			3	50	100	150
MRE 1304	Mechanics of Solids	4	1		3	50	100	150
MRE 1305	Fluid Mechanics and Machinery	4	1		4	50	100	150
MRE 1306	Machine Drawing	1		4	3	50	100	150
MRE 1307	Fluid Mechanics and Machinery Lab			3	2	100	-	100
MRE 1308	Material Testing Lab			2	2	100	-	100
MRE 1309	Workshop Practices -II			2	2	100	-	100
	Total	**21**	**4**	**11**	**26**			

Semester IV								
MRE 1401	Mechanics of Machinery	4	1		3	50	100	150
MRE 1402	Thermodynamics and Heat Transfer	4			3	50	100	150
MRE 1403	Metallurgy and material science	5			4	50	100	150
MRE 1404	Marine Electronics	4			3	50	100	150
MRE 1405	Marine Auxiliary Machinery - I	5			4	50	100	150
MRE 1406	Seamanship and Navigation	3			3	50	100	150
MRE 1407	Ship Technology	4			3	50	100	150
MRE 1408	Electrical Machines Lab			3	2	100	-	100
MRE 1409	Electronics Laboratory			3	2	100	-	100
	Total	**29**	**1**	**6**	**27**			
Semester V								
MRE 1501	Dynamics of Machinery	3	1		3	50	100	150
MRE 1502	Marine Boiler and Steam Engineering	4	1		3	50	100	150
MRE 1503	Maritime Economics and Commercial Geography	3			3	50	100	150
MRE 1504	Marine Internal Combustion Engines - I	4			4	50	100	150
MRE 1505	Marine Auxiliary Machinery-II	5			4	50	100	150
MRE 1506	Marine Engineering Drawing	1		3	3	50	100	150
MRE 1507	Naval Architecture - I	4			3	50	100	150
MRE 1508	Boiler Chemistry & Heat Engines Lab			3	2	100	-	100
MRE 1509	Work shop Practices - III			4	2	100	-	100
	Total	**24**	**2**	**10**	**27**			
Semester VI								
MRE 1601	Management Science	4			3	50	100	150
MRE 1602	Marine Electrical Technology	4	1		4	50	100	150
MRE 1603	Ship Fire Prevention and Control	4			3	50	100	150
MRE 1604	Marine Internal Combustion Engines - II	4			4	50	100	150
MRE 1605	Marine Refrigeration and Air Conditioning	4	1		3	50	100	150
MRE 1606	Machine Design and Drawing	3	1		3	50	100	150
MRE 1607	Naval Architecture - II	3	1		3	50	100	150
MRE 1608	Fire Control Engineering Lab			3	2	100	-	100
MRE 1609	Mechanical Lab			3	2	100	-	100
	Total	**26**	**4**	**6**	**27**			
Semester VII								
MRE 1701	Ship in-Campus Training	**26 weeks**			**24**	200		200
		6 months - 6 days per week						

Semester VIII								
MRE 1801	Safe Watch Keeping and Engine Room Resource Management	4			3	50	100	150
MRE 1802	Ship Operation and Management	5			4	50	100	150
MRE 1803	Marine Machinery System Design	4			3	50	100	150
MRE 1804	Marine Control Engineering and Automation	4	1		3	50	100	150
MRE 1805	Maritime Statutory Regulations	4			3	50	100	150
MRE 1806	Elective	4			3	50	100	150
MRE 1807	Simulators and Control Lab			3	2	100	-	100
MRE 1808	Seminar	2			1	100	-	100
MRE 1809	Project	1	4		4	150	-	150
MRE 1810	Viva-voce				2	-	100	100
	Total	**28**	**5**	**3**	**28**			
	Grand Total				**200**			

Note:

1. In the VII Semester, in addition to the 6 months Ship-in Campus work, all students are given mandatory training in the 4 basic modular courses (Total 12 days -72 hours) as per DGS requirements.

2. Also, students are taken onboard vessels of Cochin Port Trust and onboard ships belonging to Lakshadweep Administration (36 hrs minimum).

3. Evaluation of marks for the VII Semester is done as follows:

Proper maintenance of the work diary and training records = 50 marks
Theory Examination = 100 Marks
Viva- Voce = 50 Marks

Total = 200 Marks
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MRE 101 ENGINEERING MATHEMATICS I (65 hrs)

MODULE I

Differential calculus: Continuity and differentiability of functions of one variable, Rolle's theorem, Mean value theorem, Cauchy's theorem, L'Hospital's rule for the evaluation of limits of indeterminate forms. – 4hrs

Application of derivatives: Rate measure, Error, Extreme, Curvature, Asymptotes. -4hrs

Successive Differentiation: Higher order derivatives, n^{th} order derivatives, n^{th} order derivatives of rational functions and partial fraction, Leibniz formula for the n^{th} derivative of the product of two functions, n^{th} order derivative of the product of powers of sines and cosines. -6hrs

MODULE II

Function of more than one variable : Partial differentiation, chain rule, Euler's theorem for homogenous function, differentials and their applications in errors and approximations, Jacobians-Maxima, minima of functions of two variables. Lagrange multipliers, Exact differentials. -8hrs

Calculus of variations: The Brachistochrome problem, Euler-Lagrange development, applications of Euler's equation, several dependant variables, application to discrete mechanics, the Isoperimetric problem. -6hrs

MODULE III

Co-ordinate geometry of two dimensions : Standard equations of parabola, ellipse and hyperbola, their parametric representations, equations of tangents and normals to these curves, simple properties of these curves, asymptotes of a hyperbola, rectangular hyperbola.-12hrs

MODULE IV

Definite Integrals : Reduction formula for $\sin^n x$, $\cos^n x$, $\sin^m x.\cos^n x$ applications of definite integrals in the evaluation of length arcs, areas, area of surface of revolution and volumes. -7hrs

Multiple Integrals : Evaluation of double and triple integrals, volumes and surface areas of solids using multiple integrals. -6hrs

MODULE V

Vector Algebra: Scalar and vector product, orthogonal triad, scalar triple product, Linear dependence of vectors, other repeated products, identity of Lagrange, Reciprocal system. -6hrs

Vector differential calculus : Scalar and Vector point functions, their derivatives, curves, gradient, divergence and curl, their physical meanings, conservative force fields, scalar potential. -6hrs

References:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers,2005.
2. Erwin Kreyszing, Advanced Engineering Mathematics, John Wiley &Sons,2010.
3. S.S. Shastri, Engg. Mathematics Vol. I & II, Prentice Hall, 2004.
4. S.B. Balachandra Rao & C.K. Shantha Differential Calculus, Wiley Eastern.
5. G.B. Thomas, Calculus and Analytical Geometry, Addison Wesley,2010.

6. Shantinarayana, Engg. Mathematics Vol. I & II, S. Chand & Co.
7. S. Narayanan, Manickavachagom Pillai & Dr. G. Ramanaiah, Advanced Mathematics for Engg.,S. Viswanathan publishers, Chennai, 2002.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1102 ENGINEERING MATHEMATICS II (66 hrs)

MODULE I

Matrix Algebra: Concept of rank of matrix, Echelon and normal form, liner systems of algebraic equations, consistency, Gauss elimination method, homogenous system of equation, Eigen values and Eigen vectors, Cayley-Hamilton (no proof), Eigen values of Hermitian and Skew-Hermitian and unitary matrices, real quadratic forms, diagonalisation of quadratic forms. -10hrs

Complex Analysis : Review of algebra of complex numbers, De-Moivre's theorem, complex variables, Limit, derivative, Analytic functions, Cauchy- Rieman equations, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of an analytic function, Taylor series and Laurent series. -6hrs

MODULE II

Ordinary differential equations of first order: Formation of differential equations, variable separable, equations reducible to variable separable form, linear first order differential equation, Variation of parameters, Picard's iteration method, Orthogonal trajectories. Application to electrical circuits. -8hrs

Ordinary differential equations of higher order: Linear equations with constant coefficients, methods of solution of these equations, solution of homogeneous and non-homogeneous simultaneous linear differential equations, phase plane, critical points, stability. – 6hrs

MODULE III

Fourier Series and Fourier Integrals: Periodic functions, Eular formulae for Forier coefficients, Functions having arbitrary period even and odd functions, half range expansions, Fourier integral.
Gamma and Beta functions, error functions – definitions and simple properties. -12hrs

MODULE IV

Laplace transforms: Linearity property, transforms of elementary functions, Laplace transforms of derivatives and integrals, differentiation and integration of transforms, convolution theorem (no proof), use of Laplace transforms in the solution of initial value problems, unit step function, impulse function – transform of step functions, transforms of periodic functions. -10hrs

MODULE V

Probability and Statistics: Concepts of probability, Axioms of probability, addition theorem, Multiplication theorem, Conditional Probability, Mean, median ,mode and standard deviation, Bayes' theorem. -6hrs

Random Variables and Probability distribution: Discrete and continuous Probability distribution, joint probability distribution, Independent Random Variables, Conditional distributions., Mathematical expectations, variance and standard deviation, variance for Joint Distributions, Covariance, Correlation coefficient, Conditional Expectation. -4hrs

Special Distributions: Binomial, Poisson and Normal distributions and their properties. Square Distribution, t and F distribution. Problems and Applications. -4hrs

References:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers,2005.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern,2010.
3. Potter, Goldberg Mathematical Methods, Prentice Hall, 2008.
4. David Lewis, Matrix Theory, Allied Publishers,2008.
5. R.V. Churchill, Operations Mathematics, Tata McGraw Hill.
6. Kaplan W , Operational methods for linear Systems, Addison Wesley.
7. S. Narayanan, Manickavachagom Pillai & Dr. G. Ramanaish, Advanced Mathematics for Engineering.,S.Viswanathan Publishers, Chennai, 2002.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1103 ENGINEERING PHYSICS (66 hrs)

MODULE I

Interference of light: Interference of thin films, colours of thin films – Newton's rings (reflected system) – determination of wave length and refractive index. Air wedge-diameter of thin wire-Testing of plainness of surfaces. -12hrs

Production of X-rays-continuous and characteristic X-rays-Mossleey's law-Diffraction of X-rays-Bragg's X-ray spectrometer-Compton effect-expression fro change in wavelength. -6hrs

MODULE II

Diffraction: Fresenel and Fraunhofar diffraction-Zone place-place diffraction grating-Measurement of wave length-Dispersive of power of grating. Resolving power-Raleigh's criterior-Resolving power of telescope and grating. -6hrs

Double refraction: Positive and negative crystals-Nicol prism-Huygen's theory of double refraction. Quarter wave and half wave plates. Production and analysis of place polarized and circularly polarized light using crystal plates. Optical activity-Fresnel's theory-specific rotation-Half shade polarimeter . -6hrs

MODULE III

Coherence and lasors: Spatial and temporal coherence-coherence length-spontaneous omission-stimulated emission-population inversion-CW & Pulsed Laser, typical laser systems like Helium-Neon, Nd, YAG, Ruby, Semi-conductor lasers. Applications of lasers-Principle of holography-reflection and transmission type-Recording and reconstruction-application of holography-white light holograms. -8hrs

Electronic waves-Production, properties and application.
Recording and reproduction of sound-Magnetic tape recording sound recording on cine films. -6hrs

MODULE IV

Fiber optics and its applications: General ideas of optical fiber-NA of fiber-step index and graded index of fibers-multimode and single mode fibers-applications of optical fiber-fiber optic communication-optical fiber sensors-general ideas of intergraded optics. -10hrs

MODULE V

Marine Physics: Gyroscope, gyroscopic effect, gyro compass, SONAR, repeaters, Echo sounder, Ultra sound waves-Production, properties and use of ultra sound to measure the depth, flaw detection.
Recording and reproduction of sound-Magnetic tape recording sound recording on cine films.
Dielectrics : Types and applications. -8hrs

Superconductivity: Transition temperature-Meissner effect-Isotope effect-Type I and type II-super conductors-B.C.S. theory (qualitative study)-High temperature super conductivity (General idea)-Josephson effect-SQUIDS. -4hrs

References:

1. Sathyaprakash, Optics and Automatic Physics.
2. Theraja, Modern Physics, S.Chand Ltd.,2008.
3. Charles Kittel, Solid State Physics, Wiley, 2005.
4. Agarwal, Optical Fibre Communication,Wiley, 2010.
5. Ajoy Ghatak, Optics, Tata McGraw-Hill Education, 2009.
6. S.P. Nair & K.P. Jayaprakash, A text book for Engg. Students.
7. S. Mani Naidu, A Text book of Engineering Physics, Pearson, 2010.
8. M.C. Santhosh Kumar, Engineering Physics, Nalpat Publishers,2004.
9. Jacob Philip, Engineering Physics, Educational Publishers & Distributers, Ernakulam, 2002.
10. B. Premlet, Advanced Engineering Physics, Phasor Books, Kollam
11. A.S. Vasudeva, Modern Engineering Physics, S.Chand & Co.,2006.
12. Prabir K. Vasu and Hrishikesh Dhasmana, Engineering Physics, Ane books Pvt. Ltd.., 2010
13. S.O. Pillai & Sivakami, Applied Physics, New Age International (P) Ltd., Second Edition 2008.
14. G.S. Raghuvanshi, Engineering Physics, Prentice Hall of India, 2011.
15. J.B. Rajan, Modern Physics, PHI, 1984.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1104 ENGINEERING CHEMISTRY (72 hrs)

MODULE I

Water and its treatment : Hard and soft water-Degree of hardness of Water and its determination-hot lime – soda process-ion exchange method –calculation of soda requirements-desalination of sea water (electro dialysis & reverse osmosis) – water for domestic use – boiler feed waters – defects of using hard water in boilers and the treatments given-Bio chemical Oxygen Demand (BOD)- Chemical Oxygen Demand (COD) – Pollution – chemical characteristics – Sewage Treatment – Air pollution- causes and control. -14hrs

MODULE II

Electrochemistry & Solid State: - Electro chemical cells – EMF and its measurement (Poggendorff) – Weston cadmium cell – Nernst's equation – standard hydrogen Electrode-calomel Electrode – Edisson cell – Nickel – Cadmium cell, Metal – Air Batteries, Nickel – Metal Hydride Batteries, Lithium Batteries – PH Measurements- and Potentiometric titrations. -10hrs

Solid State: ionic, covalent, Molecular and metallic solids-crystal defects in stochiometric solids and non-stoichiometric compounds- semi conductors-organic and high temperature – Super Conductors-Liquid Crystals – L.C.D. – Nano materials – Fullerens. – 8hrs

MODULE III

Corrosion: Thermodynamics and kinetics of corrosion, Dry (Chemical) and Wet (Electro chemical)- electro chemical theory of corrosion (Evolution hydrogen and absorption of oxygen) – Factors influencing corrosion – Prevention of Corrosion – Electroplating- Hot dipping-Cathodic protection – paints- varnishes-Japans- Enamels (gloss finisher) – Lacquers., Special paints. -8hrs

MODULE IV

Fuels: Solid, Liquid and Gaseous fuels - Calorific Value of fuels and its determination – Different types of coal – importance of proximate analysis – Refining of petroleum – composition and uses of fractions – Diesel oil and petrochemicals, synthetic petrol – coal gas – Producer gas – LPG – LNG – water gas – Nuclear fission – Nuclear fusion – Fuel cells – Solar cells. -12hrs

MODULE V

High Polymers : Classification of High Polymers-production of high polymers-general methods-Some important plastics, their production, properties and uses-Polyethylene PVC, Polystyrene, Teflon, Acrylis, Nylon, Polyesters, Phenol Formaldehyde Resins, Urea Formaldehyde Resins and silicones-compounding and moulding of high polymers. – 10 hrs

Plastics and Rubber: Thermoplastics and thermosetting plastics. Natural rubber, production and properties, Compounding and Vulcanization of Rubber, Synthetic Rubbers – Buna Rubbers, Butyle Rubbers, Neoprene Thiokols, Polyurethane and a Silicons Rubbers. -10hrs

References:

1. J.C. Kuriakose & Rajaram, Chemistry in Engineering & Technology,Volume II,2009.
2. C.V. Agarwal, Chemistry of Engineering Materials, BPB Publications,2006.
3. P.C. Jain & Monika, Engineering Chemistry, Dhanpat Rai Pub, Co., New Delhi, 2002.
4. L. Munroe , Chemistry of Engineering Materials.
5. Leighou, Chemistry of Engineering Materials Tata Mac Graw Hill Publications.
6. Paul & Salger, Chemistry of Engineering Materials.
7. M. Uppal, Chemistry of Engineering Materials.
8. Dr. S. Vairam, Dr. P. Kalyani, Engineering Chemistry.
9. Shashi Chawla, A text book of Engineering Chemistry, Dhanpat Rai & Co, New Delhi, 2003.
10. Jain & Jain, Engineering Chemistry, Dhanpat Rai Publication.
11. B.K. Sharma, Engineering Chemistry,Krishna Prakasan Media(P) Ltd.,2001.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1105 ENGINEERING MECHANICS (94 hrs)
A) STATICS

MODULE I

Concurrent forces in a plane: Principles of Statics. Composition and resolution of forces, free body diagrams, Equilibrium of concurrent forces in a plane. Method of projection, equilibrium of three forces in a plane, method of moments.

Parallel forces in a plane: General case of parallel forces in a plane. Centre of parallel forces and centre of gravity, Pappus theorems, centroids of composite plane figures and curves. Distributed forces in a plane.

General case of forces in a plane: Composition of forces in a plane, equilibrium of forces in a plane. Plane trusses, method of joints and method of sections, method of members. - 16 hrs

MODULE II

Properties of areas: Moment of inertia of a plane figures with respect to an axis perpendicular in its plane, Moment of inertia of a plane figure with respect to an axis perpendicular to its plane, polar moment of inertia, Product of inertia, Principal axis, Mass moment of inertia of material bodies, radius of gyration, product of inertia of material bodies. – 12 hrs

MODULE III

Friction: Static and kinetic friction, laws of friction, Coefficient of friction, Friction angle, Energy and power lost due to friction in simple bearings, friction in belt drive, Efficiency of screw jack (square and V-thread). -8 hrs

Simple lifting machine, Graphics of load-effort and load –efficiency. Linear law, velocity ratio, mechanical advantages and efficiency of wheel and axle, differential wheel and axle, rope pulley blocks, differential pulley blocks, Warwick screw, worm driven chain blocks and single and double purchase crab winches. - 6 hrs

Principal of virtual work: Equilibrium of ideal systems, efficiency of simple machines, stable and unstable equilibrium. – 4 hrs

B) DYNAMICS

MODULE IV

Rectilinear translation: Kinematics of rectilinear motion. Differential equation for rectilinear motion. Motion of a particle acted upon by a constant force, by force as a function of time and by a force proportional to displacement. Simple harmonic motion. D'Alembrts principle. Momentum and impulse. Work and energy, ideal systems, conservation of energy. – 16 hrs

MODULE V

Curvilinear translation: Kinematics of curvilinear translation, Differential equations of motion, Motion of a projectile. D' Alembert's principal in curvilinear motion. Moment of momentum, Work and energy in curvilinear motion. – 15 hrs

MODULE VI

Rotation of a rigid body: Kinematic of rotation, Equation of motion of a rigid body, rotating about a fixed axis. Rotation under the action of a constant moment, Compound pendulum. General case of moment proportional to the angle of rotation. D'Alemberts' principle of rotation. Resultant inertial force in rotation. Principle of angular momentum in rotation. Energy equation for rotating bodies. -15hrs

References:

1. Timoshenko and Young, Engineering Mechanics , Tata McGraw Hill Company.
2. Beer F.P & Johnston E.R, Mechanics of Engineers (Vol.1 – Stastics and Vol.2-Dynamics), Tata McGraw Hill.
3. Merrian H.L. & Kraige L.G, Engineering Mechanics (Vol.1 Statics and Vol.2 – Dynamics), John Wiley and Sons.
4. Rajasekaran, S. and Sankara Subramanian. G, Fundamentals of Engineering mechanics, Vikas Publishing House Pvt. Ltd, 2000.
5. Irving-H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition , Pearson Education Asia Pvt. Ltd.
6. Hibbler R.C, Engineering Mechanics, (Vol-I Statics, Vol-II, Dynamics), Pearson Education Asia Pvt. Ltd., 2000.
7. Hannah & Stephens, Elementary Mechanics of Machines, Edward Arnold,2000.

Type of Questions for University Examination.

1. Questions from section A and section B have to be answered in a single answer sheet book.

2. Three questions each from Section A and Section B of marks 16,17,17 respectively have to be answered. Question pattern: There shall be two questions from each module with options to answer any one. Each question shall have a minimum of two sub-divisions.(section A and section B =2×(16+17+17)=100)

MRE 1106 ENGINEERING GRAPHICS (82 hrs)

MODULE I

Introduction to Technical Drawing: Drawing instruments and their use, Lettering, dimensioning, types of lines, Indian Standard Code of Practice for general engineering drawing. -6hrs

Scales: Plain Scale, Vernier Scale, Diagonal Scale. – 4 hrs

Curves used in Engineering practice: Conic Sections – Construction of ellipse, parabola, hyperbola – construction of cycloid, involute, Archimedian spiral and logarithmic spiral – drawing tangents and normals to these curves. – 8 hrs

MODULE II

Orthographic Projections: Plane of projection of first angle and third angle projections, projection of points in different quadrants. -4hrs

Orthographic projection of straight lines: Lines parallel to one plane and inclined to the other plane, straight lines inclined to both the planes, true length and inclination of lines with reference planes, traces of lines. – 8hrs

Projection of plane lamina: Projection of plane lamina of geometrical shapes in oblique positions. -4hrs

MODULE III

Projection of solids : Projection of solids with axis perpendicular to one plane, axis parallel to both plane, axis inclined to horizontal or vertical planes and parallel to the other plane, axis inclined to both planes. -10 hrs

Section of Solids: Projection of solids sectioned with planes perpendicular to H.P. or VP, inclined to axis of the solids. Drawing true shape of the section. -6hrs

MODULE IV

Development of surface: Developing the surface of prisms, cylinders, pyramids and cones. -8hrs

Intersection of surfaces: Drawing the curves of intersection prism to prism, intersection of cylinder to cylinder and intersection of cylinder to cone. -8hrs

MODULE V

Isometric projection: Isometric scales, isometric views, isometric projections of prisms, pyramids, cylinders, cones and spheres. Sectional views of simple machine components in isometric. -10hrs

Perspective projections: Visual ray method and vanishing point method of perspective projection of circles, prisms and pyramids. -6 hrs

References:

1. P.I. Varghese & K.C. John, Engineering Graphics, JET Publishers,1995.
2. N.D. Bhat, Elementary Engineering Drawing, Charotar Publishig House,2011.
3. P.S. Gill,Geometric drawing, B.D. Kataria & Sons, Ludhiana,11th edn.
4. K.C. John, Engineering Graphics, PHI Learning, 2009.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1107 FUNDAMENTALS OF ENGINEERING – I (98 hrs)
(A) MECHANICAL ENGINEERING

MODULE I

Thermodynamic definitions and Properties of Gases: Thermodynamic systems – open, closed and isolated systems, equilibrium state of a system, property, state, process, cycle, work, equations of state of real gas, specific heats, critical constants. Zeroth law of thermodynamics – concept of temperature, temperature scales. First law of thermodynamics -internal energy, enthalpy, application of first law to close and open systems- calculation of heat and work transfer in various processes. Second law-Kelvin-plank and Clausius statements, Carnot Cycle. -16hrs

Internal Combustion Engines: Working of two stroke and four stroke Petrol and Diesel engines, Carbureted and MPFI engines, fuel pump, fuel injector, ignition system, cooling system, lubricating system. -6hrs

MODULE II

Ideal Gas cycles : Air standard efficiency of Otto cycle, Diesel Cycle, Dual Cycle, Brayton Cycle,4 stroke and 2 stroke cycles, indicator diagram, compression ratio and thermal efficiency, Indicated power, brake power, frictional power, Mechanical efficiency, specific fuel consumption, Energy balance. -10hrs

MODULE III

Steam and Two Phase System: Phase equation of steam, Temperature – Pressure diagram, Triple point, Specific Enthalpy and Entropy, Use of steam tables and charts, Pressure – volume , Enthalpy- Entropy diagrams, Internal Energy of vapours, Super critical vapours, non flow process with steam. -12hrs

Boilers: Simple boiler, Boiler Calculations, Boiler thermal efficiency and equivalent evaporation of boiler. -4hrs

(B) ELECTRICAL ENGINEERING

MODULE – IV

Basic Principles of Electric Circuits:- Review of Ohm's law - Definitions of resistance, current, voltage and power series and parallel circuits - constant voltage source and constant current source. -6hrs

Network Theorems:- Kirchoff's Laws - Network analysis by Maxwell's circulation currents, Thevenin theorem, Norton's Theorem, Super - position theorem, Maximum power transfer theorem; Simple illustrative problem on network theorems. -6hrs

MODULE – V

Electrostatics :- Coulomb's law, Electric field strength and Electric flux density, capacitance, magnetic fields of a coil; field strengths; Ampere turns and its calculations; Hysteresis; Magnetic circuits involving air gaps; Magnetic leakage and Fringing. -8hrs

Electromagnetic Induction: - Faradays law, Lenz's law, self and mutual induction, Energy stored in a magnetic field. -4hrs

MODULE – VI

AC Fundamentals: - Generation of alternating voltage and current equations of sinusoidal voltage and current, wave form, cycle frequency, time period, amplitude, phase difference, r.m.s. and average values, power factor, peak factor, form factor, vector diagram using r.m.s. values, sine waves in phase and out of phase, phasors, phasor algebra. -8hrs

AC Circuits:- R, L, C, Circuits, RL, RC, RLC circuits; series and parallel current, voltage & power relationships, series and parallel Resonance. -6hrs

Poly phase circuits:- 3 phase system; vector representations, phase sequence, star and delta connections, power measurement in 3 phase systems using 1, 2 & 3 watt meters. -4hrs

Wiring Systems:- Distribution of power, House wiring, types; ISI Rules; Megger testing, wiring accessories and wires, diagrams; Earthing; method of measuring earth electrode resistance.
Electrical Safety Precautions:- Electric shock, precaution to avoid electric shock treatment.
Fuses:- Different types of fuses – rewirable, HRC fuse. Miniature circuit breakers. -8hrs

References:

1. B.L.Theraja, A.K. Theraja, A text book of Electrical Technology Vol I, S.Chand, 2005.
2. M.L. Anwani, Basic Electrical Engineering,Jain Books, 2012.
3. Nagrath and Kothari, Basic Electrical Engineering,Tata Mc Graw Hill, 2001.
4. R.Muthu Subramanian,S. Salivahanan, K.A. Muraleedharan, Basic Electrical, Electronics and Computer Engineering, Tata Mc Graw Hill, 1999.
5. Badri Ram & Viswakarma, Power system protection and switch gear,Tata McGrawHill.
6. P.K. Nag ,Engineering Thermodynamics, Tata Mac Graw Hill Publishers.
7. D.B. Spalding & E.H. Cole, Engineering Thermodynamics, Academic Press.
8. Van Wylon, Engineering Thermodynamics,Wiley, 2002.
9. P.L. Ballaney, Thermal Engineering, Khanna Publishers, 1994.
10. ELBS, Electrical Technology, Wheeler publications, 2003.
11. H. Cotton, Advanced Electrical Technology, CBS, 2004.

Type of Questions for University Examination.

1. Questions from section A and section B have to be answered in separate answer books.

2. Three questions each from Section A and Section B of marks 16,17,17 respectively have to be answered. Question pattern: There shall be two questions from each module with options to answer any one. Each question shall have a minimum of two sub-divisions.(section A and section B =2×(16+17+17)=100marks)

MRE 1108 FUNDAMENTALS OF ENGINEERING II (88 hrs)

(A) ELECTRICAL AND ELECTRONIC MEASUREMENTS

MODULE I

Basic requirements of measuring instrument, control and damping devices, moving coil, moving iron, dynamometer and thermocouple type of ammeters, voltmeters and watt meters, extension of instrument range. -16hrs

MODULE II

Single phase and three phase wattmeter for power measurement, measurement of energy, measurement of speed, frequency and phase difference, measurement of resistance, inductance and capacitance by bridge method, Potentiometers. -14hrs

MODULE III

Magnetic measurements, Localisation of cable faults, Transducers and its application in the measurement of pressure, flow and temperature, Illumination and its measurements.

Electronic measuring devices:- CRO, Signal generator, Timers, Multimeters, Digital voltmeter, Q meter, frequency meter. -12hrs

(B) BASIC ELECTRONICS ENGINEERING

MODULE IV

Electron Emission: Thermionic emission, Photoelectric emission, electric field emission and their applications. -4hrs

Semiconductors : Types, electrical characteristics, diffusion and drift, mobility, Varistors, Thermistors and Non linear resistors. -4hrs

Semi conductor Diodes: Characteristics of PN diodes, diode as a rectifier, Zener diodes, tunnel diodes. -3hrs

Transistors:- Junction transistor and its characteristics, transistor as a switch, amplifier, Biasing, low and high frequency responses. Effect of positive & negative feedback in transistor amplifiers. -7hrs

MODULE V

JFET & MOSFET, BJT, UJT, SCR, Full wave and bridge rectifiers, TRIAC, DIAC. -6hrs

Regulated Power Supplies: Series Regulators, Shunt Regulators, PNM Regulator. -6hrs

MODULE VI

Oscillators: Requirements for oscillations, phase shift Oscillator, Wein Bridge Oscillator, Crystal Oscillators, tank circuits – LC Oscillators. -10hrs

Wave Shaping and Switching: Clipping, Clamping, time, base or Sweep Generator, Multivibrators & Schmitt Triggers. -6hrs

References :

1. Doblin, Measurements, Tata Mc Graw Hill, 2007.
2. G.K. Mithal, Electronics Devices & Circuits, Khanna Publishers,1994.
3. Ben G.Streetman, Solid State Electronics Devices, PHI Learning,2009.
4. A.K.Sawhney, A course in Electrical and Electronics Measurements and instrumentation, Dhanpat Rai & Sons,2001.
5. Albert D. Helfrick, William D.Cooper, Modern Electronic Instrumentation and Measurement Techniques,PHI, 1988.
6. M.M.S.Anand, Electronic Instruments and Instrumentation Technology, Prentice Hall of India Pvt.Ltd.,2004.
7. V. K. Mehta, Rohit Mehta, Principles of Electronics, S.Chand & Co.,2004.
8. R. S. Sedha, A Text Book of Applied Electronics, Sultan Chand Publishers,2000.
9. N.N. Bhargava, D.C.Kulshresh.., S.C. Gupta, Basic Electronics & Linear Circuits,2001.

Type of Questions for University Examination.

1. Questions from section A and section B have to be answered in separate answer sheet book.

2. Three questions each from Section A and Section B of marks 16,17,17 respectively have to be answered. Question pattern: There shall be two questions from each module with options to answer any one. Each question shall have a minimum of two sub-divisions.(section A and section B =2×(16+17+17)=100 marks)

MRE 1109 COMPUTER FUNDAMENTALS (80 hrs)

MODULE I

Basics of Computer & Information Technology: Important components of a computer system – secondary storage devices- Central Processing Unit, Memory, Input-Output devices. Secondary storage devices, machine language, assembly language, and high level language, system software, operating systems, Compilers and assemblers, General introduction to various computer network systems such as, LAN, WAN, etc. -12hrs

MODULE II

Introduction to programming in C : Fundamental data types – integer, floating point and enumerated data types, Expression – arithmetic, relational and logic operations, type convention – simple and compound statement, IF, SWITCH, WHILE, DO WHILE, FOR, BREAK, CONTINUE, GOTO, RETURN statements. -15hrs

MODULE III

Dynamic Data Structures : Declaration and functions, parameter passing mechanism, storage classes – scope, visibility and life time of variables, AUTO, EXTERN, STATIC and REGISTER modifiers, Recursion. -13hrs

Arrays : Single and multi dimensional arrays, storing, selection sort, search-linear search and binary search, Structures to union, pointer and addresses, pointer arrays, function returning pointers, pointers to function, pointer arithmetic, pointer to structures, arrays of structures, preprocessor directive, command line arguments, type definition. - 12hrs

MODULE IV

Introduction to DBMS : Relational, network and hierarchical models (description only).
Introduction to relational algebra and SQL.

Object Oriented Programming (OOP): OOP concepts and fundamentals, encapsulation, definition of an object, inheritance and multiple inheritance, attributes and methods, polymorphism, Interfaces, class diagrams, virtual functions. -14hrs

MODULE V

User defined data types: Structure – Union - Enumerated data type – programs involving structure and union.

Files: File concept – File pointer – File handling operations (open, close, read, write etc.) on sequential and random access files. Programs on file manipulations using fgetc(), fgets(), fseek(). -14hrs

References :

1. Roger Hunt and Jihn Shelly, Computers and Common Sense,PHI,2007.
2. Leon & Leon, Internet for everyone, Tata McGraw Hill, 2008.
3. B.S. Gotfried , Programming in C, Schaum seris, TMH,1996.
4. Kernighan, B.W.K. & Ritchi D.M, The C Programming Language, Prentice Hall of India, 1989.
5. Richard Johnson-baugh & Martin Kalin, Application Programming in C, Macmillan International Edition, 1990.

6. Schildt, H, C made easy, Tata McGraw Hill Book Company, 1987.
7. Pradip Dey & Manas Ghosh, Computer Fundamentals & Programming in C, Oxford.
8. R G Dromey, How to solve it by Computer, Pearson Education,2008.
9. D.E. Knuth, The Art of Computer Programming – Volume 1,2 &3, Pearson,2002.
10. Yashwant P. Kanetkar, Let Us Use C, Johns Barlet Publishers,2008.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1110 ENVIRONMENTAL STUDIES AND TECHNICAL COMMUNICATION

A - ENVIRONMENTAL STUDIES (30hrs)

MODULE I

Natural resources - issues related to the use and over exploitation of forest resources, water resources, mineral resources, food resources, energy resources and land resources- role of an individual in conservation of natural resources - equitable use of resources for sustainable life styles.

Concept of an ecosystem - structure and function - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - structure and functions of a forest ecosystem and an aquatic eco system.

Definition of biodiversity - genetic, species and ecosystem diversity - biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Threats to biodiversity, Conservation of biodiversity.

MODULE II

Environmental Pollution - Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, marine pollution, thermal pollution and nuclear hazards - Causes, effects and control measures of urban and industrial solid wastes -Role of an individual in prevention of pollution - An overview of the various environmental legislations in India - Issues involved in enforcement of environmental legislation. Disaster Management: Floods, earth quake, cyclone and landslides. Role of public awareness in disaster management.

MODULE III

The concept of sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, water shed management - Resettlement and rehabilitation of people; its problems and concerns - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies - Population growth and problems of population explosion – Environment and human health – Human rights – Value education – Role of Information Technology in environment and human health - Environmental ethics: issues and possible solutions.

References:

1. Rajagopalan. R, Environmental Studies: From Crisis to Cure, Oxford University Press,2005.
2. Erach Bharucha, Textbook of Environmental Studies and Ethics, Universities Press (India), Hyderabad, 2005.
3. Jayashree A. Parikh, V.M. Balsaraf, P.B. Dwivedi, Environmental Studies, Ane Books Pvt. Ltd., 2010.
4. Anindita Basak, Environmental Studies, Pearson, 2009.
5. Gouri Suresh, Environmental Studies and Ethics, I.K. International Publishing House Pvt. Ltd., New Delhi, 2007.
6. S.P. Misra, Essential Environmental Studies, 3rd Edition, Ane Books Pvt. Ltd., 2011.
7. Benny Joseph, Environmental Science & Engineering, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
8. Meenambal T , Uma R M and K Murali, Principles of Environmental Science and Engineering, S. Chand & Company Ltd, 2005.

B - TECHNICAL COMMUNICATION (30hrs)

MODULE I

Communicative Grammar: Time, tense and aspect; Verbs of state and event; Use of preposition; Expressing emotions and attitudes: Hope, anticipation of pleasure, disappointment, approval, disapproval, surprise.

The sounds of English: (it is not a course in phonetics. Technical terms will not be used except when absolutely necessary.)

Length of vowels-long and short vowels

/ | /, / 3 : /, /a :/, / : /, /U : / | / / 2 /, /,/ Λ /, / O /, / U / - Consonants : / f, v, o, o, s, z, 3/ - Stress pattern -

Intonation: failing and rising.

Oral Communication: starting and ending a conversation; telling and asking people to do things; expressing opinions and ideas, decisions and intentions, offers and invitations, feelings, right and wrong, numbers and money.

Purpose and audience; dealing with customers and clients; face-to-face discussions; interviews; group discussions; meetings and attending meetings; checking understanding; raising questions; giving and receiving feedback; using body language; leading and directing discussions; concluding discussions; using graphics in oral presentations

Reading Comprehension and reference skills: skimming and scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; comprehending graphics in technical writing.

Reading strategies; reading speed; reading between the lines for hidden meaning; interpreting graphics; using a dictionary; using an index; using a contents list to find information; choosing the right reference source.

MODULE II

Written Communication: note making and note taking; summarizing; notes and memos; developing notes into text; organization of ideas: cohesion and coherence; Preparing notes – writing business letters and E-mail messages. Organizing a meeting, preparing an agenda, chairing a meeting, drafting motions and resolutions, writing minutes.

Paragraph writing: Paragraph writing – Topic sentence, cohesion and coherence- sentence liners (so, but, however etc), ordering information in space and time; short essays: description and argument; comparison and contrast; illustration; using graphics in writing: tables and charts; diagrams and flow-charts; maps, plans and graphs. Preparation of a business report-writing a business proposal - format, length,structure.

Spelling rules and tips; writing a rough draft; editing and proof reading; writing the final draft; styling text; filling in complex forms; standard letters; Writing a curriculum vitae (both chronological & functional) along with an application for a job.

MODULE III

Public relation – Concept and relevance – PR in a business organization-handing the media; writing a report; writing leaflets and brochures; writing references; essay writing: expository writing; description of processes and products; classification; the instructional process; arguments and presentation of arguments; narrating events chronologically.

References:

1. John Seely, Oxford Guide to Writing and Speaking, Oxford University Press.
2. C. Muralikrishna and Sunita Mishra, Communication Skills for Engineers, 2nd Edition, Pearson, 2011.
3. Meenakshi Raman and Sangeetha Sharma, Technical Communication: Principles and Practice, Oxford University Press, 2004.
4. Krishna Mohan and Meenakshi Raman, Effective English Communication,Tata Mc-GraHill,2000.
5. William Sanborn Pfeiffer, T.V.S. Padmaja, Technical Communication – A Practical Approach, Pearson, 2007.
6. R.C. Bhatia, Business Communication, 2nd Edition, Ane Books Pvt. Ltd., 2008.
7. Krishna Mohan and Meera Banerji, Developing Communication Skills, Mac Millan India Ltd, 2000.

Type of Questions for University Examination.

1. Questions from section A and section B have to be answered in separate answer books.

2. Three questions each from Section A and Section B of marks 16,17,17 respectively have to be answered. Question pattern: There shall be two questions from each module with options to answer any one. Each question shall have a minimum of two sub-divisions.(section A and section B =2×(16+17+17)=100 marks)

MRE 1111 COMPUTER PROGRAMMING LABORATORY (68 hrs)

Application packages

Word	1. To create an advertisement in Word.
	2. To illustrate the concept of mail merging in word.
Spread Sheet	3. To create a spread sheet to analyse the marks of the students of a class and also to create appropriate charts.
Power Point	4. To create the presentation for the department using Power Point.

C Programming Basics

Operators & Expressions	5. To write a simple menu driven calculator program
	6. To write Programs illustrating switch and break statements.
IO Formatting	7. To write a program to print Pascal's triangle.
Decision Making	8. To write a program for electricity bill preparation.
Looping	9. To write a program to print the sine and cosine series
	10. Calculating averages for different sets of numbers using nested loops
Arrays	11. To write a program to perform Matrix multiplication.
	12. To write a program to prepare and print the sales report.
	13. Largest and smallest of a set of numbers using function.
	14. Programs illustrating relationship between array elements & their addresses.
	15. Arranging an array of numbers in an order using different sorting algorithms.
String	16. To write a program to perform string manipulation manipulations function like string concatenations, comparison, find the length and string copy without using library functions.
	17. To write a program to arrange names in alphabetical order.
Functions	18. To write a C program to calculate the mean, variance and standard deviation using functions
	19. To write a C program to perform sequential and binary search using functions.
	20. Calculating factorial of a +ve number using function
Recursion	21. To write a program to print the Fibonacci series and to calculate the factorial of the given number using functions.
	22. Calculating factorial of a +ve number using recursion.
Structures	23. To print the mark sheet of n students using structures.
Pointers	24. To write a program using pointers to access the elements of an array and count the number of occurrences of the given number in the array.
	25. To design a simple class object.

MRE 1112 WORKSHOP PRACTICES - I (136 hrs)

MECHANICAL WORKSHOP

1. Fitting Shop
2. Sheet metal Shop
3. Smithy Shop
4. Welding Shop
5. Carpentry Shop

(Preliminary exercises for beginners in all shops. Specific models may be designed by the teachers)

ELECTRICAL WORKSHOP

1. Determination of equivalent resistance under (a) series and (b)parallel and (c) series – parallel connections..
2. Measurement of armature resistance and shunt field resistance by ammeter and voltmeter method.
3. Continuity test by ohmmeter and multi-meter.
4. Study of constant current source.
5. Measurement of high resistance.
6. Calibration of ammeter (dc&ac).
7. Calibration of voltmeter (dc&ac).
8. Volt-ampere characteristics of lamps.
9. To study the connections of a fluorescent tube with electromagnetic ballast (To measure input power, voltage and current and to compute power loss in the ballast resistor).
10. To study the connections of a fluorescent tube operated from a 220 V dc mains. (To measure input power, voltage and current and to compute power loss in the ballast resistor).
11. Measurement of low resistance by Kelvin Double bridge.
12. Wattmeter connections and measurement of power.
13. Localisation of faults in electrical circuits.
14. Characteristics of an ac series circuit and set to resonance.
15. Characteristics of an ac parallel circuit and set to resonance.
16. Staircase wiring.
17. Hospital wiring.
18. Gowdown wiring.
19. Different types of joints.

MRE 1113 LANGUAGE LABORATORY (30hrs)

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Objectives:

1. To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
2. To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams.
3. To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.

SYLLABUS :

The following course content is prescribed for the **English Language Laboratory** sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. Debate and group discussions
9. Telephoning Skills.
10. Giving Directions.
11. Practice of communication onboard ship- internal communication-communication between office and shore staff.

MRE 1301 ENGINEERING MATHEMATICS – III (70 hrs)

MODULE I

Sampling Theory: Population and sample, sampling with and with out replacement, Random samples, Population parameters, sample statistics, sample mean, sampling distributions of means, sample variance mean variance and moments for grouped data. -8hrs

Curve fitting, Regression and Correlation: Curve Fitting, the method of least squares, the least square line, least square lines in terms of sample variance and covariance, Regression lines, regression coefficient, the least square parabola, multiple regression, standard error of estimate, linear correlation coefficient, Probabilistic interpretations of regression and correlation. -8hrs

MODULE II

Digital Mathematics –Introduction to Errors in Numerical Calculations: - Absolute Error, Relative Error, Percentage Error. Solution to Algebraic and Transcendental Equation: - Bisection Method, the Method of False Position, Newton-Raphson Method. -8hrs

Binary Codes: Weighted and Non-weighted Binary codes, Error detecting codes, Error correcting codes, Alphanumeric codes.

Logic Circuits: Sum-of -Product Boolean expression, Product of Sum Boolean expression, use of De Morgan's Theorems, use of NAND logic, Mode of NOR logic, Numerical analysis. -6hrs

MODULE III

Calculus of Finite Differences: Differences of a function, fundamental operators of the calculus of finite differences, Algebra of finite difference operators, fundamental equations satisfied by finite difference operators, difference tables, Difference Equation with constant coefficients. Application to oscillation of a chain particle connected by strings and an electrical line with discontinuous leaks. -14hrs

MODULE IV

Interpolation Formulae: Newton-Gregory forward and backward interpolation formulae, Legrange interpolation formula, Newton's Divided difference interpolation formula, Sterling interpolation formula. Derivative of tabulated function, Integral of a tabulated function, Summation formula. -14hrs

MODULE V

Computing: Design of efficient algorithms for problems like factorial of a positive integer, Fibanocci sequence generation, Sin x, Cos x, e^x series summation, Linear search problem, Bubble sort problem, Merging problem, calculation of computational complexity. -12hrs

References :

1. Ervin Kreyszig, Advanced Engineering Mathematics,Wiley Eastern,2011.
2. Potter, Goldberg, Mathematical Methods, Prentice Hall India, 2011.
3. Churchill R.V.,Fourier series and Boundary Value problems, Tata McGraw Hill,2011.
4. Irvin Miller & John E. Friend , Probability and Statistics Engineers, Prentice Hall of India,2005.
5. Bowker and Lieberman, Engineering Statistics and Probability for Engineering Science

and Technology, Prentice Hall,1972.
6. Krik-Patrick, Introductory Statistics and Probability for Engineering Science and Technology, Prentice Hall.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1302 ELECTRICAL TECHNOLOGY (105 hrs)

MODULE I

Transformers : Working principle, constructional feature of single phase transformer, e.m.f. equation, phasor diagram under no load and load conditions, leakage reactance, equivalent circuits, voltage regulation, losses and efficiency, open circuits and short circuit tests, parallel operation, three phase transformers – core and shell type, current and potential transformers, auto transformer – single phase and three phase. -18hrs

MODULE II

D.C. Machines : Principle of Direct current machines, Their construction, winding, e.m.f. equations, Armature reaction, commutation, brush shift, compensating winding. -10hrs

D.C. Generator: Characteristics, methods of excitation, parallel operations, performance equations. -8hrs

D.C. Motor: Characteristics, starting and reversing, speed-torque equations, starters, speed control including electronic method, testing of D.C. machines for finding losses and efficiency, Reversing & braking of D.C. motor. -8hrs

MODULE III

Induction Motor : Three phase induction motor: Principals of operation and theory of action, slip speed, rotor to stator relationship, rotor frequency, rotor e.m.f. and current, equivalent circuit relationship between rotor I^2R loss and the rotor slip, torque-slip characteristics, starting torque and maximum running torque, reversing, speed control of induction motor, starting of induction motor, method of starting- D.O.L., Star/Delta, Autotransformer, testing – No load & blocked rotor tests; circle diagram. -15hrs

Single phase induction motors : Principle and operational characteristics, starting control, constructional details. Failure and repairs of electrical machines. -3hrs

MODULE IV

A.C. Machines : Alternator: General arrangement of alternator, construction of salient pole and cylindrical- rotor type, types of stator windings, e.m.f. equation of an alternator, distribution and pitch factor, wave form of generated e.m.f., load characteristics and regulation, parallel operation of alternators, KW & KVA sharing. -14hrs

Synchronous alternator & motor : Production of rotating magnetic field, conditions for its production and reversal of its direction. Principal of operation of 3-phase synchronous motor, Armature reaction, open circuit & short circuit tests, torque/angle characteristics and hunting, Methods of starting, merits and limitations of synchronous motor over others. -14hrs

MODULE V

Power Transmission and Distribution: Two wire and 3-wire D.C. distribution.
A.C. Distribution: single and three phase transmission and distribution, comparison of D.C. and A.C. transmission. Use of balancer, 2-wire, 3-wire & 4-wire A.C. distribution, copper efficiency

under different modes of distribution, one end fed and Ring main distributor, fuses and its materials, D.C. air circuit breaker, A.C. air circuit breaker. -10hrs

References:

1. M.G. Say, Direct Current Machines, Financial Time management, 1986.
2. M.G. Say, The Performance & Design of A.C. Machines,CBS Publishers,2005.
3. Vincent Del Tore, Electric Machines, Prentice Hall of India, 1989.
4. Nagrath , Electrical Machines, Tata Mc Graw Hill, 2004.
5. B. L. Theraja, A. K. Theraja, A Text Book of Electrical Technology – Vol. II – AC & DC Machines, 2005 Edn .
6. J.B. Gupta, Theory and Performance of Electrical Machines, S.K.Kataria & Sons, 2009.
7. Dr. P.S. Bhimbra. Electric Machinery, Khanna Publishers, 2011.
8. R. K. Rajput, Electrical Machines, Fire wall media, 2006.
9. V. K. Mehta, Rohit Mehta, Principles of Power System, S.Chand, 2008.
10. C.L. Wadhwa, Electrical Power Systems,New Age International, 2005.
11. S. N. Singh, Electric Power Generations, Transmission and Distribution,PHI,2004.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1303 WORK SHOP TECHNOLOGY (60 hrs)

MODULE I

Common workshop tools: description and uses of different types of calipers. Straight edges, try squared, vices, hammers, chisels, scrapers, files, drills, reamers, tapes, v-blocks, face plates, marking blocks, carpentry tools, pattern markers tools, Smithy tools and Moulding tools. -6hrs

Machine process: The geometry of cutting process, mechanics of cutting, chip formation, cutting forces, stresses and power friction of chip on tool. Generation and dissipation of heat in cutting. Standard nomenclature for cutting tools. Cutting speeds and feeds, estimation of machining time. The fundamental of cutting process, application in hand tools as chisel, file and saw geometrical control of cutting edge. -9hrs

MODULE II

Machine tools: Kinematic analysis, specification, operation and inspection of important types of metal cutting machine tool including center lathes, capstan and turret lathes, automatic lathes, drilling and boring machines. Shaping, slotting and planing machines, milling and broaching machines. Turning, screw cutting and taper turning process on center lathe, Abrasive process, Grinding, honing and lapping by and machines. Shears and punches, wood working machines, Principles of jigs and fixtures standardization. - 15hrs

MODULE III

Measuring instruments and inspection. Description and use of steel rule venires scale, micrometer, dial gauge, depth gauge, feeler gauge, wire gauge, pattern markers scale, taper gauge, snap gauge, optical methods of measurement, principles of interchangeability, limit system, use of limit gauss. - 8hrs

MODULE IV

Fitting and overhauling: Types of packing and jointing materials and their uses, design considerations and construction of various types of valves and cocks, reducing valves for steam and air. Bedding of bearings, marking of engine parts for fitting, machining operations fittings of keys, cotters, etc. – 6hrs

Safety measures: sources of danger and methods of protection. Types of guards and safety devices, factory act regulations. -4hrs

MODULE V

Welding: Welding equipment and applications, electric welding A.C. and D.C. spot welding, gas welding, Soldering and brazing, Different welding electrodes, solders and brazing fluxes. -10hrs

References:

1. Boothroyd, Fundamentals of Metal Matching and Machine Tools, McGraw Hill.
2. Sen and Bhattacharya, Metal Cutting Theory and Practice, New Central Book. Agency, Calcutta.
3. H.M.T , Production Technology, Tata Mc Graw Hill, 2007.
4. Black, Theory of Metal Cutting, Tata McGraw Hill, 1961.
5. M.C.Shaw, Metal cutting, Oxford University, 2004.

6. Yankee, Manufacturing Process, Prentice Hall, 1978.
7. Sharma, Text book of Production Engineering, S.Chand and Co.,2006.
8. Delela Publication, Manufacturing Science and Technology Vol. II, TMH,2009.
9. Pandey and Shah, Modern Machining Processes, Tata McGraw Hill, 2008.
10. Koeingberg, Matching science and their application, Pergamon Press.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1304 MECHANICS OF SOLIDS (90 hrs)

MODULE I

Stress and Strain : Concept of stress and strain, and their relationship in deformable solids. Hook's law, Poisson's ratio, relationship between three elastic constants, Stress in axially loaded members, statically indeterminate problems, axial stresses in composite materials, thermal stress, elastic strain energy for uni-axial stress and strains, strain energy due to impact loads. -12hrs

Compound Stress and Strain: Stresses on an oblique section, general two dimensional stress system, Principal planes and Principal stresses, Mohr's diagram for stress. Principal strain in three dimensions, Strain Rosette. -4hrs

MODULE II

Bending Stresses: Pure bending, stresses due to bending, position of Neutral axis, radius of curvature, combined bending and direct stress, short column with eccentric loading, composite beams. – 10hrs

Axial force, Shear force & Bending Moment Sign convention, Relation between intensity of loading, shearing force and bending moment, graphical construction of shear force and bending moment diagrams. -10hrs

MODULE III

Deflection of Beams: Deflection by integration, Macaulay's method and moment area method of deflection coefficients. -8hrs

Built-in and Continuous Beams: Moment-area method, fixed beam with central concentrated load, fixed beam with concentrated load not at the center, fixed beam with uniformly distributed load, continuous beam, Clapeyrons three moment theorem. -10hrs

MODULE IV

Torsion : Torsion of circular shafts, stiffness and strength, shafts with linear and compound shafts, Partial hollow shafts, Calculation for coupling bolts. -12hrs

Springs: Torsion applied to closed coil springs, springs with axial loads, Calculation of mean diameter of the spring, wire diameter and number of coils. Strain energy in torsion. -6hrs

MODULE V

Thin Shells : Stresses and strains in thin walled shells subjected to internal pressure, stresses and strain in submersibles. Strengthening of thin walled shells by wire or tape winding, effect of temperature; volumetric strain on capacity. -6hrs

Thick Cylinders : Stresses and Thick cylinders, Lame's theory, compound cylinders. Solid shaft subjected to radial pressure, shrinkage allowance, Applied problems. -6hrs

Theory of Columns : Euler's theory and Euler's buckling load, Struts with both ends pin joined, both ends fixed, one end fixed and one end free, one end fixed and one hinged, pin joined strut with eccentric load, Rankine-Gordon formula, Applied problems formulae, effect of end conditions - 4hrs

Theories of failures: Various theories of failure and their applications to ductile materials. -2hrs

References:

1. E. P. Popov , Introduction to Mechanics of Solids, Prentice Hall India, 2007.
2. S.P. Timoshenko & D.H. Young, Elements of Strength of Materials , International Students Edition, McGraw Hill, 2003.
3. Stefan H Crandall, Nouman C. Dahl An Introduction to the Mechanics of Solids, International Students Edition, McGraw Hill.

Type of Questions for University Examination.
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Both A and B shall have a minimum of two sub-divisions.

MRE 1305 FLUID MECHANICS AND MACHINERY (75 hrs)

MODULE I

Fluids and their Properties : Fluids, shear stress in a moving fluid, viscosity, Newtonian and Non-Newtonian fluids, properties of fluids- viscosity, surface tension, capillarity. -1hr

Hydrostatics : Pressure, variation of pressure in a static fluid, absolute and gauge pressure, measurement of gauge pressure, hydrostatic forces on plane and curved surfaces, center of pressure, buoyancy and stability of submerged and floating bodies, metacentric height. -7hr

Dimensional Analysis & Dynamic Similarity: Use of dimensions for finding conversion fators, Dimensions of common quantities, Dimensions equations, Rayleigh's method, Buckingham π-theorem, Geometrical and dynamical similarity, general principles, similarity problems. - 4hrs

MODULE II

Fluid in Motion: Ideal fluids, Equations of continuity in the differential form, rotational and irrotational flow, Stream function, Velocity potential, one dimensional flow along a steam line, Burnaulli's equation and its limitations, discharge through orifice, experimental determination of orifice coefficient, venturi meter, orifice meter, flow nozzles, notches and weirs, time required to empty reservoirs of various shapes, flow from one reservoir to the other reservoirs. -8hrs

Flow through Pipes: Losses of energy in pipe lines , Losses due to sudden expansion and contraction, friction losses, Transmission of power by pipe line, condition for max. power transmission, derivation of Darcy and Chezy's formula, parallel flow through pipes. -7hrs

MODULE III

Fluid Friction, Viscous and Laminar Flow: Resistance coefficient, variation of resistance coefficient with Reynlod's No., oiled bearings, Critical velocity, viscous flow through pipes, Power required for viscous flow, flow between parallel planes. -7hrs

Vortex Motion & Radial Flow: steady and unsteady flow, Two dimensional flow theory, forced vortex, free vortex, Radial flow free spiral vortex, compound vortex. -7hrs

MODULE IV

Dynamic Action of Fluid: Momentum equation applied to a control volume, impact of jets, flow of an incompressible fluid over affixed and moving vanes, work done and efficiency. -4hrs

Hydraulic Turbines: Velocity triangles, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine, their constructional feature and performance characteristics – non dimensional parameters for comparative study of turbine performance, theory of draft tubes, speed regulation of turbines, selection of type and speed of turbines. -12hrs

MODULE V

Centrifugal pumps: classification, principles of working, calculation of various heads, work done per unit weight, velocity diagrams, dimensions of impellers, calculation of power input, losses in pumps, efficiencies, non dimensional parameters, specific speed, NPSH, cavitation in centrifugal pumps. - 9hrs

Reciprocating Pumps: Various types, single and double acting, single and multi cylinder, coefficient of discharge, theoretical indicator diagrams, effect of acceleration and friction, use of air vessels. - 9hrs

References:

1. Douglas, Gasiorek and Swaffield, Fluid Mechanics, Pitman,1983.
2. Daugherty & Franzini, Fluid Mechanics with Engg. Applications,McGraw Hill,1997.
3. Dr. Jagdish Lal, Hydraulic Machines, Metropolitian Book Co.,1982.
4. N.S. Govinda Rao, Fluid Flow Machines, Tata McGraw Hill,1983.
5. F.M. White, Fluid Mechanics, Tata Mc Graw Hill, 2011.
6. Vallentine, Applied Hydrodynamics Butter Worths ,London.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1306 MACHINE DRAWING (80 hrs)

MODULE I

Orthographic Projections: Orthographic projection in 1st & 3rd angle projections of simple machine components from given Isometric drawings. Drawing of the third view from the given two views in orthographic projections. - 10hrs

Details of sectioning: Sectioning of components at the central axis, Part sectioning, simple assembly drawings with sectional views. - 6hrs

MODULE II

Projection of Ports: Projection of ports and openings in hollow cylinders, Parallel cut and radial cut ports, Rectangular and Tapered ports in right cylinders, Tapered ports in tapered cylinders, Example of diesel cylinder liners, Steam piston valve liner and blow down cock. – 16hrs

MODULE III

Thread formation, Nuts, Bolts & Studs: V-thread and square thread details, Metric & BSP threads, General conventions for drawing of threads in engineering drawing, Standard bolts, nuts, studs and tapped holes, Special bolts and screws e.g. tapped bolts, collar bolts and studs, pinching screws, cheese headed and round headed screws, Various types of locking arrangements of nuts. – 16hrs

MODULE IV

Machinery Components Drawing: Drawing of complete machine components in assembly (Orthographic to Orthographic and isometric to Orthographic) with details like Couplings, Glands, Return and non-return Valves, Cocks & Plugs, Cylinder and Piston assembly connecting rod with bearings, Boiler mountings. - 16hrs

MODULE V

Marine Component Drawing: Assembly Drawings of simple marine components in Orthographic projection from Isometric views e.g. Bilge Strainer Boxes, Marine Diesel Pistons 2-stroke & 4-stroke types, Control Valves, Cylinder Relief Valve, Boiler Blow-down valves, Diesel Engines, Rocker arms. - 16hrs

References:

1. P.I.Varghese & K.C. John, Machine Drawing, VIP Publishers, 2006.
2. N.D.Bhatt, Machine Drawing, Charotar Publishing House, 2007.
3. V.Lakshmi Narayana & M.L. Madhur, Machine Drawing, New Age International,2006.

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MRE 1307 FLUID MECHANICS AND MACHINERY LABORATORY (50 hrs)

Study of pipe fittings and study of devices used for measurement of pressure, velocity, rate of flow.
Experiments :

1. Experimental verification of Bernoulli' theorem.
2. Steady flow through pipes – determination of friction factor and Reynold's number.
3. Determination of losses coefficients of pipe fittings.
4. Hydraulic coefficients of mouth pieces, nozzles and bend meters.
5. Determination of coefficient of discharge through various Notches.
6. Determination of Metacentric height and radius of gyration of floating bodies.
7. Calibration of Venturi meters and orifice meter.
8. Force due to impact of jets on vanes.
9. Performance characteristics of centrifugal pumps at constant speed.
10. Constant head characteristics of Francis Turbine.
11. Constant Head characteristics of Pelton Wheel.
12. Performance of Hydraulic Ram.

Board of impellers of pumps for practical demonstration specially required for Design Work.

Note : Students must present the laboratory records fully certified by the teacher to the Head of the Department before commencement of the semester examinations.

MRE 1308 MATERIAL TESTING LABORATORY (34 hrs)

Experiments:

To determine the behaviour of different materials when subjected to Tension and to obtain the following Tensile properties of materials on Universal Testing Machine: (i) UTS, (ii) Yield Stress, (iii) Young's Modulus, (iv) Breaking Stress, (v) Percentage Elongation, (vi) Percentage reduction in area and (vii) Plotting of Curve of Stress vs Strain.

To determine the behaviour of materials under direct shear force and to study the effect of it and to calculate the shear stress of material.

To study the behaviour of materials when subjected to bending and to find out the effect of such act on material and to calculate the bending stress of materials.

Determination of the behaviour of different materials when subjected to sudden shock and to calculate the impact resistance quality or the impact strength of the materials.

To determine the hardness of materials by indenting a hardened steel ball into the specimen under test by an applied specified load on the ball.

Determination of behaviour of ductile materials when subjected to torsion and to obtain (i) Maximum Torsion Stress, (ii) Modulus of Rigidity and (iii) Plotting of curve of Angle of Twist vs Torque.

To determine the stiffness of springs for (a) round wire and (b) square section wire when subjected to compression.

Determination of compressive stress and strain of materials under compressive force applied to the material.

To find out the Tensile stress of materials on hand operated Tensile Testing Machine.

Note : Students must present the laboratory records fully certified by the teacher to the Head of the Department before commencement of the semester examinations.

MRE 1309 WORKSHOP PRACTICES - II (36 hrs)

Machine Shop

Straight Turning.
To make a round Tensile Test Specimen.
To make a step pulley.
Straight Turning under cut with taper.
To make a pin with under cut and threads.
Stepping down with knurling operation.
Taper turning and inside boring.
Making of Hexagonal end with under cut taper turning and thread cutting.
Shaft key making.
Thread cutting by Taps and Die.
Thread cutting by Lathe Machine.
Rectangular Block making by Shaping Machine.
Key way making by Milling Machine.
Gear cutting by Milling Machine.

MRE 1401 MECHANICS OF MACHINERY (90 hrs)

MODULE I

Introduction: Mechanism and machines; plane mechanisms; kinematic chains and their classification; kinematic inversion; equivalent linkages. -4hrs

Kinematic analysis of plane mechanisms: introduction; general case of plane motion; velocity acceleration; Corioli's component; velocity and acceleration images; Arnold Kennedy's theorem of three centers; velocity analysis using instantaneous centers (graphical method only). Analytical treatment of four bar mechanism and slider-crank mechanism. -11hrs

MODULE II

Path generator: Pantograph, exact straight line mechanism- Peaucellier mechanism & Thompson indicator mechanism.
- 3hrs

Cams: Classification of cams and followers; geometry of radial cam; displacement diagram; uniform, simple harmonic, parabolic and cycloidal motions; graphical layout of cam profiles; basic follower motions; displacement, velocity, acceleration and jerk relations; comparison of follower motions; pressure angle, comparison of follower curvature; analysis of tangent cam, convex and concave sided cams with roller follower and with flat footed follower, polynomial cam design. - 12hrs

MODULE III

Governors: Function of a Governor, comparison between a Governor and a fly wheel, Various types of Governors, centrifugal and inertia types of Governors, Sensitiveness, Stability, Hunting of Governors, Governor effort and power, consideration of friction in Governors. -25hrs

MODULE IV

Spur gears: Gear terminology; conjugate motion; involute arc of action; contact ratio; generation of gear tooth profiles; interference; cycloidal properties; comparison of characteristics of involute and cycloidal profiles; interchangeable gears; standard and non-standard gear tooth properties; description of different types of gears such as helical, bevel, and worm gears. -10hrs

Gear trains: Introduction; example of gear trains; simple and compound gear trains calculation of gear ratios, epicyclic gear train, solution of epicyclic gear train problems. -5hrs

MODULE V

Belt and Rope Drives: Ratio of belt tensions, power transmitted, centrifugal tension, and initial tension, flat belts, v-belts and ropes. - 8hrs

Clutches: Analysis of single plate, multi-plate and cone clutches. - 4hrs

Brakes: Analysis of different types of brakes-block brake, band brake, internal expanding shoe brake, condition for self locking, power transmitted and heat generated. - 6hrs

Dynamometers: rope brake dynamometer, belt transmission dynamometer. - 2hrs

References:

1. J.E.Shigley & J.J.Uicker, Theory of machines and mechanisms, Oxford University Press,2003.
2. J.E.Shigley, Kinematic analysis of mechanisms, Tata McGraw Hill,1969.
3. Thomas Beven, Theory of machines, CBS, 1996.
4. Zimmerman, Elementary kinematics of mechanism, John Wiley Publication.
5. Rattan, Theory of machines, Tata McGraw Hill, 2005.

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Both A and B shall have a minimum of two sub-divisions.

MRE 1402 THERMODYNAMICS AND HEAT TRANSFER (84 hrs)

MODULE I

The Second Law of Thermodynamics: Different statements of the second law of thermodynamics, Carnot's cycle, thermodynamic reversibility, Carnot's theorem, Thermodynamic temperature scale, Clausius inequality, entropy, change in entropy in various thermodynamic process, Steam and gas processes on T-S and H-S diagram, availability, reversibility, irreversibility. -10hrs

Thermodynamics of combustion: Definition of fuels, combustion. Combustion equations, Analysis of the products of combustion, stoichiometric combustion, Actual combustion, Excess air, Mixure strength, Dissociation, Effect of dissociation on IC Engines. - 9hrs

MODULE II

Steam Power Cycle: Carnot cycle, Rankine cycle, Reheat cycle, regenerative cycle, Binary vapour cycle and its effect on thermal efficiency, cycle efficiency, work ratio. - 8hrs

Steam Engines: Modified Rankine cycle for steam engines, hypothetical indicator diagram, mean effective pressure and work transfer, diagram factor, Indicated power, specific steam consumption. Indicated thermal efficiency, mechanical efficiency, efficiency ratio, Compound steam engine, missing quantity. -6hrs

Flow of steam through Nozzles and Diffusers: One dimensional steady flow of compressible fluids, isentropic flow, effect of friction, Critical condition, super saturated flow. - 6hrs

Steam Turbines: General principles of impulse and reaction turbines, compounding of turbines- velocity, pressure and pressure-velocity compounding, velocity diagrams of impulse and reaction turbines, effect of friction on blades, force on blades, work done by blades, axial thrust, diagram efficiency, stage efficiency, overall efficiency . Condition for maximum energy transfer in impulse Turbines, Parson's Reaction Turbine, Degree of reaction, Velocity diagrams, Condition for maximum energy transfer, Reheat factor. -13hrs

Lubrication of Turbines: Suitable oils and their properties, lubrication of main bearings, thrust bearings and gears. Gravity and pressure lubrication, oil system and emergency lubrication arrangement. – 4hrs

MODULE III

Reciprocating Air Compressors : Ideal cycle for compressors, work Transfer in single stage compressor, Mass and volume flow, Free Air Delivery, Effect of clearance and volumetric Efficiency in Single stage compressors, Multi-stage compression neglecting clearance and with clearance. Condition for Minimum work Input and Perfect Intercooling. Tandem and In-line arrangement in compressors. Rotary positive Displacement Types of compressors. Compressed air Motors. Applied Problems. – 10hrs

MODULE IV

Transmission of heat: Fourer's law of heat conduction , thermal conductivity of insulating materials, conduction through flat, cylindrical and spherical surfaces in series. Heat transfer from fluids to fluids through walls. Radiation- Basic, Stephan-Boltmans , Gray body, Black body. – 8hrs

MODULE V

Application of heat transfer in Marine Heat Exchangers, like heaters, coolers, Condensers. Prediction of convection heat transfer rates. Use of non-dimensional groups- Prandtl No., Nusselt No., Reynolds No., Stanton No., Grashof No., Grates No. Natural and forced convection.

– 10hrs

References :

1. J.P. Holman, Heat Transfer, Tata McGraw Hill, 2008.
2. C.P. Gupta and R. Prakash , Engineering Heat Transfer, Nem Chand & Bros,1999.
3. P.K. Nag, Engineering Thermodynamics,Tata Mc Graw Hill, 2005.
4. D.B. Splading and E.H. Cole, Engineering Thermodynamics, 3rd Edn.
5. Van Wylon, Engineering Thermodynamics, Wiley, 1998.
6. J.P. Holman, Engineering Thermodynamics, Tata Mc Graw Hill,1980.

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MRE 1403 METALLURGY AND MATERIAL SCIENCE (90 hrs)

MODULE I

Crystallography : crystal structure, space lattice, crystal systems, miller indices of crystal planes and directions, atomic density of crystallographic planes and lines, atomic packing factor, co-ordination number, inter planar spacing. -8hrs

Crystal imperfections : point defect, line defect, edge dislocation, screw dislocation, interaction between dislocation, planar defects, stacking faults, grain boundary, twist and twin boundaries, volume defects.

-6hrs

Solidification of metals : homogenous and heterogeneous nucleation, crystal growth, grains and grain boundaries, equi-axed and columnar grains, dendritic pattern, polymorphism. -4hrs

MODULE II

Solid Solutions: Equilibrium between phases, Gibb's phase rule, solid solution, interstitial, substitutional, ordered and disordered types, Hume – Rothery rules, equilibrium phase diagrams of binary alloys-complete solid solubility, partial solid solubility, no solid solubility, eutectic, peritectic and eutectoid reactions, intermetallic compound. -12hrs

Allotropy of iron: Iron-carbon Equilibrium diagrams. Equilibrium diagrams of Cu- Ni, Cd-Bi, Pb-Sn, and Ag-Pt systems as examples. -6hrs

MODULE III

Heat treatment of steel: Definition and aims of heat treatment, T T T diagram, isothermal and continuous cooling, annealing, normalizing, hardening, tempering, austempering, mar tempering, hardenability of steels, jominy test, surface treatments –case hardening, carburizing, cyaniding, nitriding, flame hardening, induction hardening, metal coating- hot dipping, electro plating, metal cladding, impregnation, metal spraying. -12hrs

Metals and Alloys: Cast Irons **:** classification- gray, white, malleable, and spheroidal graphite cast irons, composition, properties and uses. Steels : Classification of steels, function of alloying elements of steels, composition and properties of common commercially important alloy steels.
Non-ferrous alloys: composition, properties and use of common commercial alloys of Cu, Al, Mg, bearing metals.
Classification society rules – National & International standards of different class of steels.

-10hrs

MODULE IV

Deformation of metals : Elastic, anelastic and visco elastic behaviour, plastic deformation, mechanism of slip, slip planes and slip directions, mechanism of twinning, strengthening mechanisms, work hardening, grain boundary hardening, precipitation hardening, cold working, hot working, recovery, recrystalisation and grain growth. -8hrs

Failure of metals : creep, mechanism of creep, creep curves, creep resistant materials, fracture, brittle fracture, Griffith's theory, ductile fracture, ductile-brittle transition, protection against fracture, fatigue, mechanism of fatigue, S-N Curve. - 8hrs

MODULE V

Testing of Materials: Destructive tests – Tensile test, compression test, hardness test, bend test torsion test ,and impact test. Non-destructive tests – Magnetic dust test, Fluoresent test, Ultrasnic test Radiographic test. - 6hrs

Uses of Materials **in Shipboard Application:** Chromium, Ceramic, Titanium, PTFE in shipboard systems. Characteristics of the above materials. - 2hrs

Selection of materials in shipbuilding &Marine Engineering : Boilers, Steam and Gas turbines, Purifiers and Diesel engine components, Pumping Machinery, Components and piping system, Engine seating, Propellers and Rudders. Composition, strength value and other requirements for materials used. - 8hrs

References:

1. L.W. Van Vlack, Elements of material science and Engineering, Parson,1989.
2. Reed Hill, Physical metallurgy principles, Affiliated east-west press, New Delhi, 4th Edn.,Cengage Learning,2009.
3. Clark & Varney, Physical metallurgy for engineers, CBS,2004.
4. V.Raghavan, Material science and engineering, Prentice Hall of India, 2004.
5. Dieter, Mechanical metallurgy, Tata McGraw Hill, 1988.
6. Avner, Mechanical metallurgy, Tata McGraw Hill, 2nd Edn., 2009.
7. Narula, Material Science, Tata McGraw Hill, 2007.
8. B.K.Agarwal, Introduction to engineering materials, Tata McGraw Hill, 2008.
9. Manas Chanda, Science to Engg. Materials Vol I, II and III, Macmillan Co. of India,1981.

Type of Questions for University Examination.

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MRE 1404 MARINE ELECTRONICS (65 hrs)

MODULE I

Transistor Power Amplifiers : Class A, B & C amplifiers, efficiency, distribution, Design theory, Symmetry, practical complimentary, Push –Pull amplifier, Phase inverter, maximum output power & load resistance and transistor dissipation, Heat sink design. – 9hrs

Operational Amplifier Theory: Concept of differential Amplifiers, Linear OP-amp circuits. -8rs

MODULE II

Digital Circuits: Logic systems and Gates, Binary and BCD codes, Boolean Algebra, Simplifications, Flip-flops, Counters, Registers and Multiplexers. - 10hrs

Binary Codes: Weighted and Non-weighted Binary codes, Error detecting codes, Error correcting codes, Alphanumeric codes, Basic logic gates-AND and Not gates, combining logic gates, NAND,NOR, Exclusive-OR, Exclusive-NOR gates, converting gates with inverters. - 6hrs

Converters (A-D and D-A) : Analog to Digital and Digital to Analog converters and their uses in Data Loggers. - 4hrs

MODULE III

Digital Integrated Circuits: TTL & CMOS Gates- Semi conductor Memories- ROM, RAM, and PROM. - 8hrs

Industrial Electronics: Power Rectification, Silicon Controlled Rectifiers power control, Photo-electric devices, Inverters. -6hrs

MODULE IV

Communication: Modulation, Demodulation, AM/FM/PM Wireless, Radio Transmitters and Receivers, T-V Radar, Pulse communication. Satellite communication as applicable to GMDSS. - 8hrs

MODULE V

Microprocessors : 8085 Architecture – Programming – interfacing and Control of motors – Temperature / Speed control. -6hrs

References:

1. Milman & Halkias, Electronic Devices and Circuits, Tata Mc Graw Hill, 2008.
2. Millman & Halkias, Integrated Electronics, Tata Mc Graw Hill, 1991.
3. Bhargava, Basic Electronics, Tata Mc Graw Hill, 1984. :
4. NED Mohan, Power Electronics, John Wiley, 2003. :
5. Rolf IseRmann, Mechatronic Systems Fundamentals, Springar International Edition, 2005.
6. W. Bolton, Mechatronics, Pearson Education, 4th Edn.,2008.
7. Singh & Joshi, Mechatronics, PHI, 2006.
8. Ramesh Gaonkar, Microprocessor Architecture, programming and Applications with the 8085, Penram International Publishing Inda Pvt.Ltd., 2006.

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MRE 1405 MARINE AUXILIARY MACHINERY-1 (66 hrs)

MODULE I

Engine Room Layout: Lay out of main and auxiliary machinery in engine rooms of different ships. **Engine Room Piping Arrangements & Fittings:** Pipe material, Piping arrangement for steam, bilge, ballast and fuel oil systems, Lub oil and Cooling system lines with various fittings for main and auxiliary engines. Domestic fresh water, sea water and hydrophore system. Colour coding and safety fittings of pipelines etc. -12hrs

Bunkering procedure, precautions taken, Line diagram for H.F.O & D.O. - 4hrs

MODULE II

Blowers and Compressors: Operational and constructional details of blowers and compressors used on board ships, Uses of compressed air. -4hrs

Evaporators: Construction and Operation of different types of evaporators, Fresh Water generators and distillers. Conditioning arrangement of distilled water for drinking purpose. Use, Care and Maintenance of pumps of various types. - 5hrs

MODULE III

Valves and cocks: Straight way cocks, right angle cock, 'T' cock, spherical cock, Boiler gauge glass cock (cylindrical cock). -3hrs

Valves: Globe valves, SDNR valve, swing check valve (storm valve), gate valves, butterfly valves, relief valves, quick closing valves, pressure reducing valves, control valves, change over valve chests, fuel oil transfer chest, valve actuators and steam traps. -4hrs

Jointings: Packings, Insulation materials, Types – Various applications. Seals-purpose of bearing seal, description and application of non rubbing seals and rubbing seals, simple felt seal, seals suitable for various peripheral speeds, V-ring seals, Lip seals. -4hrs

Filters: strainers and filters, types of marine filters, auto clean and Duplex filters, Static filters, Priming and core maintenance of filters. - 5hrs

MODULE IV

Deck Machinery: Various types of deck machinery used in ships e.g. Winches and Wind lass and their requirements. Operation and maintenance of Davits, Deck Cranes, Electric and Hydraulic deck machinery; hydraulic motors, line filters and systems. - 8hrs

Heat Exchangers: tubular and plate type, reasons of corrosion, tube removal, plugging, and materials used. - 3hrs

Job requirement for a watch-keeping Engineer. - 3hrs

MODULE V

Oil Purification and Treatment: Theory of oil purification, various methods of oil purification, Principles of operation and construction of different Centrifuges for heavy fuel and lubricating oil like FOPX system, Self desludging etc. Uses of Homogenizers, Use of settling / service tanks & precautions taken before entering / cleaning tanks. Treatment of Fuels for combustion in Marine I.CEngines and Steam Plants. Residual fuels, Emulsified Fuels, Merits and demerits of such fuel in marine engines. -6hrs

Pumps: Types of pumps for various requirements, their characteristics and application in ships. Centrifugal Pumps, Gear Pumps, Screw Pumps and Reciprocating Pumps, submerged pumps-Care and Maintenance of pumps. - 5hrs

References:

1. Smith D.W, Marine Auxiliary Machinery, Butterworth Publication London,6th Edn.,1983.
2. Khetagurov.M, Marine Auxiliary Machinery and Systems,University press of Pacific,2004.
3. Cowley, The Running and Maintenance of Marine Machinery, IME Publications, 1992.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1406 SEAMANSHIP AND NAVIGATION (55 hrs)

MODULE I

Seamen and their duties: Ship's Department, general ship knowledge and nautical terms like poop-deck forecastle, bridge etc. - 2hrs

Deck equipment: winches, derricks cranes, gypsy, capstan, hatches, and their function. -2hrs

Navigational lights and signals: Port and Star board, forward and aft mast lights, colors and location. Look out, precautions and bad weather, flags used on ships, flag etiquette, Morse and Semaphore signaling, sound signals. - 6hrs

MODULE II

Anchors: their use, drooping and weighing anchor, cable stopper. - 6hrs

MODULE III

Navigation: General knowledge of principle stars. Sextant, navigation compasses echo sounder, log and uses, barometer and weather classification, G.M.T. and zonal time, wireless navigational instruments, radar satellite navigation etc. - 6hrs

MODULE IV

Life boats and life rafts: Construction, equipment carried, carrying capacity. Davits and their operation. Launching of life rafts (inflatable type). Embarkation into life boat and life raft. Stowage and securing arrangement, Equipments inside life boats and life rafts, including radio life saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids. -6hrs

Abandon ship: Manning of life boats and life raft, rescue boats, Muster list. Radio and alarm signals, distress signal S.O.S. Distress Calls time and radio frequency. Pyro-techniques. - 8hrs

MODULE V

Survival at sea: survival difficulties and factors, equipment available, duties of crew members, initial action on boarding, maintaining the craft. -4hrs

Practical: Knots, bend and hitches, Ropes splice, donning of life jackets, Life boat drills, Lowering and hoisting and life boats (model). - 8hrs

MARPOL Convention and its annexes, Regulatory control towards environmental pollution at sea. - 4hrs

Note: Lesson plans to comply with the requirements of SOLAS & STCW-2010 Code and Convention.

References:

1. John R. Annapolis, Book of Seamanship, Symon and Schuster Publication,2014.
2. Danton & Graham, Theory and Practice of Seamanship, Routledge, 11th Edn., 2009.
3. Brain C.H,Nicoholl's Seamanship & Nautical Knowledge, Brown,Son& Ferguson,2004.
4. House D.J, Marine Survival and Rescue System, Cornell maritime Press, 1988.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1407 SHIP TECHNOLOGY (72 hrs)

MODULE I

Ships Terms : Various terms used in Ship Construction with reference to Ship's parameter e.g. L.B.P., Moulded Depth, Moulded Draught etc., General Classification of Ships. - 4hrs

Stresses in Ship's Structure : Bending, Shear, Hogging, Sagging, Racking, Pounding, Panting, etc., and Strength members to counteract the same. - 6hrs
Sections and materials use : Type of section like Angles, Bulb Plates, Flanged beams used in ship construction. Rivetting & Welding. Testing of Welds. Fabricated components. - 6hrs

MODULE II

Bottom & Side Framing : Double bottoms, Water tight floors, Solid and bracket floors, Longitudinal framing keels, side framing like Tank side brackets, Beam Knee, Web Frame, etc. - 7hrs

Shell & Decks : Plating systems for shells, Deck plating & Deck girders, discontinuities like hatches and other openings, supporting & closing arrangements, mid-ship Section of ships.- 7hrs

Bulk Heads & Deep Tanks : Water tight bulk heads, Arrangements of plating and stiffeners. Water tight sliding doors, Water tight openings through bulk heads for electric cables pipes and shafting. Deep tank for oil fuel or oil cargo corrugated bulk heads. - 7hrs

MODULE III

Fore-End Arrangements : Stem construction, arrangements to resist panting, panting stringers, Forepeak-Collision bulk heads, Bulbous bows. Anchor and Cable arrangements. - 6hrs

After-End Arrangements : Types of Stems, Stern frame and rudder. Types of rudder. Supporting of rudder, Locking pintle, Bearing pintle, Rudder shaft carrier bearing, Shaft tunnel, Tunnel bearings. - 7hrs

MODULE IV

Loadline and Tonnage: Definition of freeboard and various assigning conditions, List of closing appliances, Loadline Surveys, Tonnage regulations, calculation as per 1969 convention, details of markings permanently carved. -4 hrs

Shipyard Practice : Layout of a Shipyard, Mould loft, Fabrication of assembly, Subasembly, units in construction, role of Surveyors in construction of Ship; Keel laying, Launching, Sea trial. Use of computers in ship design with cost implication. - 4hrs

MODULE V

Offshore Technology : Drilling Ships and Platforms, Supply/Support Vessels-types and Constructions, Dynamic Positioning, Deep Sea Diving System, Fire Fighting Arrangement, Cable Laying Vessels. -4hrs

Ship Surveys : Survey, Rules, Functioning of Ship Classification Societies, Surveys during Construction, Periodical Surveys as per statutory regulations, retention/suspension of class of a ship, constructional features and rule guidelines for a merchant vessel as per Marpol regulations, IBC and IGC codes. Statutory Certificates and their validity, Ships registration formalities, Intact

Stability Criteria under damaged conditions (constructional point of view in compliance with statutory regulations), Enhanced Survey requirements, HSSC. -8hrs

References:

1. Muckle, Naval Architecture for Marine engineers,2004.
2. Tupper E, Introduction to Naval Architecture, Butterworth-Heinemann,2013.
3. Comstock, Principles of Naval Architecture, Society of Naval Architects, 1990.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1408 ELECTRICAL MACHINES LABORATORY (51 hrs)

1. Calibration of the single phase energy meter by direct loading at various power factors.
2. Measurement of power in the three phase circuit using single, two and three watt meters for balanced/unbalanced load and three and four wire systems.
3. To study an auto- transformer and load it at about 10% (a) higher and (b) lower input voltage.
4. Determination of the efficiency and regulation of the single phase transformer by direct loading.
5. Determination of Equivalent circuit of a transformer by open and short circuit test calculation of efficiency and regulation at various loads and power factors.
6. Parallel operation of two single phase transformer.
7. To study dismantled parts of a D.C. machine.
8. To study dismantled parts of an A.C machine.
9. Emf induced in a d.c. machine.
10. Parallel operation of two identical DC shunt generators.
11. To study and run a rotary convertor under different conditions to record the generated voltage on D.C side against variation of load.
12. To perform a load test on a 6-pulse, 2-way bridge rectifier and to obtain the characteristic curves.
13. To study different types of motors, connect A.C. supply, run the motor and obtain its speed load characteristics (The experimental multi motor set).
14. To study the slip-torque characteristics of an induction motor and to find the full load slip.
15. To compute full load input, torque, slip, power factor, efficiency of 3-phase induction motor from circle diagram. Also to compare the results from the circle diagram with actual full load test on the motor.
16. Determination of the regulation of a 3-phase alternator by synchronous impedance method.
17. Synchro transmitter and Repeater.
18. Determination of phase sequence in a 3-phase supply.
19. Study of a single phase controller.
20. Observation of wave form of magnetizing current and hysteresis loop.

21. Study of transformer differential delay.

22. Determination of the regulation of the alternator by emf and mmf methods.

23. Synchronisation of alternator to the A.C. mains and studying the effect of changes in excitation of alternator and power input to their alternator by plotting the V-curve.

24. Starting the cage induction motor using star-delta switch and plotting the performance characteristics.

25. Conducting the no load and blocked rotor tests on slip ring induction motor –determining equivalent circuit and calculating torque-slip characteristics.

26. a) Plotting OCC of a D.C. shunt generator at rated speed – determining the critical resistance.

    b) Conducting load test on D.C. shunt generator and plotting external characteristics – deducting internal characteristics.

27. Conducting load test on D.C Series motor and plotting the performance characteristics.

28. Study of single phase capacitor start and capacitor run induction motors – plotting speed – voltage relation of single phase fan motor.

Note: Students must present the laboratory records duly certified by the teacher to the Head of the Department before commencement of the semester examinations.

MRE 1409 ELECTRONICS LABORATORY (51 hrs)

1. To study the charging and discharging action of a capacitor
2. To study the half wave and full wave rectification circuit without and with filter circuit
3. To study the volt-ampere characteristic of high current semiconductor diode
4. To study the volt-ampere characteristic of a diode and Zener diode
5. To study the characteristic of Junction Transistor
6. To study the volt- ampere characteristic of Field Effect Transistor.
7. To study the characteristics of Silicon Controlled Rectifier.
8. To study the Transistor Bias stability
9. To study the Transistor Feed Back Amplifier
10. To study the Integrated Circuit operational Amplifier
11. To study the Integrating, Differentiating Clamping and Clipping Circuit
12. To study the Logic Training Board
13. To study the Speed control of a D.C. motor by Thyristor.
14. Arithmetic operations using microprocessor 8085
15. Logical operations using 8085
16. Array operations using 8085
17. Speed and Direction control of stepper motor using 8085.

MRE 1501 DYNAMICS OF MACHINERY (70 hrs)

MODULE I

Force analysis of plane motion mechanisms : Static Force Analysis: Analysis of four bar chain – slider crank chain – static force analysis with friction. Dynamic force analysis: D'Alembert's principle, inertia forces, dynamic force analysis of four bar chain, slider crank mechanism, shaking forces. - 8hrs

Dynamics of reciprocating engines: gear force, equivalent masses, inertia force in the single engine, bearing loads in the single cylinder engine. -4hrs

MODULE II

Flywheels: inertia torque-turning moment diagrams for multi cylinder engines, coefficient of fluctuation of speed and energy, fly wheel mass calculation, effect of centrifugal tension on fly wheel. -8hrs

Gyroscopes : motion of rigid body in 3 Dimension, Euler's equation of motion, gyrodynamics, gyroscope and gyroscopic couples, gyroscopic stabilization of ships and aeroplanes, gyroscopic effects on automobiles. - 8hrs

MODULEIII

Balancing: Static and dynamic balancing, balancing of several masses in a plane, balancing of masses rotating in several planes, conditions for complete balancing of an engine, reciprocating and rotating parts, locomotive balancing- hammer blow, variation of tractive effort, swaying couple, locomotive balancing of opposed piston engines. Multicylinder in-line engines – radial engines and V engines. Balancing machines and their principles of working. - 12hrs

MODULE IV

Fundamentals of vibration: Kinematics of vibratory motion: simple harmonic motion, periodic motion and Fourier analysis.

Vibrations of single degree of freedom systems: natural vibration, equation of motion, natural frequency, equilibrium method, energy method, viscous damping, logarithmic decrement, coulomb damping, forced vibration, harmonic excitation with and without damping, non dimensional expression for amplitude and phase, rotating unbalance, critical speed for shafts, support excited motion, vibration isolation.

Vibration measuring instruments: Seismometer, accelerometer, vibration exciters. - 15hrs

MODULE V

Free vibration of two degree and multi degree freedom systems: solution for free vibration, normal modes, vibration absorber, coupled vibration, general solution, matrix method of formulation, numerical evaluation of natural frequencies and natural mode.

Approximate numerical methods: Rayleigh's method – Dunkerly method.

Torsional vibration in multi – rocker systems, geared system. - 15hrs

References:

1. Rattan, Theory of machines, Tata McGraw Hill, 2005.
2. Hollowenko, Dynamics of machinery, McGraw Hill.

3. Singeresu S.Rao, Mechanical Vibrations, Pearson, 4th Edn., 2009.
4. Myklestad, Fundamentals of vibration analysis, Literary Licensing, 2012.
5. Denharto, Mechanical Vibration, McGraw Hill, 2007.
6. Thomas Beven, Theory of machines , CBS Publications, 1998.
7. A.Ghosh & A.Mallik, Theory of machines and mechanisms, Affiliated east west press, 1988.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1502 MARINE BOILER & STEAM ENGINEERING (85 hrs)

MODULE I

General Considerations governing the design of Boilers: Types of marine boilers, comparison of smoke tube and water tube boilers; Destructive and Non-destructive tests on plates, rivets, welded seams, classification societies requirements for boilers construction. -5hrs

Smoke Tube Boilers: Various types in marine use, Principal dimensions and staying of flat surface of multi tubular cylindrical Boilers. Vertical Auxiliary Boilers. - 5hrs

Water Tube Boilers: General description with sketches of principal types of boilers in marine use. -5hrs

MODULE II

Waste Heat Boilers: Waste Heat recovery calculation, Lamont exhaust gas boiler. Scotch composite Boiler, Cochran exhaust gas and composite boiler, Spanner marine exhaust gas and Composite boiler. Forced Water Circulation Boiler, Double evaporation Boilers. -6hrs

Boiler Mountings: Safety Valves – Improved High Lift, Full lift and Full Bore type : Gauge Glass – Ordinary plate type and remote Indicator; automatic feed regulator, three element High & Low water level alarms, Main Steam Stop Valves, Retractable type Soot Blower etc. -4hrs

Accessories : Superheater, Economizer, Air pre-heater & Steam pre-heater; Circulation and use of Unheated Down comers in highly rated boilers; Superheat temperature control, Attemperators and De-superheaters. - 4hrs

MODULE III

Operation, Care & Maintenance: Pre-commissioning procedures, Hydraulic tests, Steam raising and Operating Procedures, Action in the event of shortage of Water. Blowing down of Boiler, Laying up a boiler; general maintenance, External and Internal tube cleaning. Tube renewals, etc. Maintenance, inspection and survey of boilers. -6hrs

Refractory : Purposes of refractory, types of refractory and reasons for failure. - 2hrs

Oil burning : Procedure of Liquid fuel burning in open furnace, Various types of atomizer, Furnace arrangement for oil burning, Boiler Control System i.e. master control, fuel control, air control and viscosity control. - 4hrs

MODULE IV

Reciprocating/Steam Engines: History of multiple expansion marine reciprocating engines & steam turbines. -5hrs

Layout of Plant: General layout of plant & description of a modern geared steam turbine installation including auxiliaries in modern use. - 4hrs

Selection of Materials : Materials used in various components like blades, rotors, castings, sealing glands, gears etc. & their justification. - 2hrs

Constructional Details : Types of blades, method of fixing, solid built-up & drum rotor for impulse and reaction turbines, castings for HP and LP impulse and reaction turbines, diaphragms, nozzles, glands, carbon glands, labyrinth packing glands, main bearings and thrust bearings. - 12hrs

MODULE V

Condensers : Shapes and types of condensers, constructional details, location & method of securing, working principles, contraction and expansion allowances, leak test. Effect – change of temperature, circulating water quantity, change of main engine power, condenser surface. -5hrs

Operation and Maintenance : Turbine drain system, turbine gland steam, warming through a turbine plant, control of speed and power of propulsion, throttle valve control and nozzle control, emergency controls, emergency operation of turbines, vibration in marine steam turbine, steam turbine losses. Breakdown and fault finding. - 13hrs

Alignment Checking : By bridge gauge and poker gauge, allowances for expansion, sliding foot, thrust bearing static and dynamic balancing - 3hrs

References:

1. J.H.Milton, Marine Steam Boilers, Butterworth, 1980.
2. SC Mc Birnie and W J Fox, Marine Steam Engines & Turbines, Butterworth, 1980
3. Harrington, Marine Engineering, SNAME, 1992.
4. Kandy Series Vol. IV, Steam Engines, IMarEST, 2002.
5. Kandy Series Vol. II, Marine Boilers, Butterworth- Heinemann, 1990.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1503 MARITIME ECONOMICS & COMMERCIAL GEOGRAPHY (55 hrs)

MODULE I

The economic organization of the shipping Market: The economic role of the shipping industry- The international Transport system- The demand for sea transport – The world merchant fleet- The role of ports in the transport system.

Major Shipping Routes- Ports- types, Problems, factors for good port. Major ports of India and World. -14hrs

MODULE II

Supply, Demand and Freight rates: The shipping market model **-** The supply of sea transport – The demand for sea transport – The freight rate mechanism- Factors influencing in determining various equilibrium. -8hrs

MODULE III

Cost, Revenue and Financial Performance: The impact of financial pressures on ship owners'decisions – Financial performance and investment strategy – the cost of running ships – various revenue receipts – Voyage cash flow analysis and annual cash flow analysis- the internal rate of return. -8hrs

MODULE IV

The economic principles and global pattern of Maritime trade: Countries that trade by sea – Theories about the pattern of trade- Economic growth and sea trade – geographical distribution of seaborne trade- Bulk cargo and the economics of bulk shipping – The general cargo and the economics of liner shipping - India's overseas Trade and Economic Importance with reference to Economic zones. -12hrs

MODULE V

The economics of ships and ship designs: Relationship between cargo units and ship types – ships for liner trades, ships for dry bulk trades, liquid bulk trades, combined carriers- economic criteria for evaluating ship design.

The economics of ship building and recycling: The ship building market supply and demand model – The ship recycling industry – Economics of ship recycling industry.

Maritime forecasting and market research: Principles of forecasting – forecasting methodologies – market research methodology. -13hrs

References:

1. Maritime Economics, Martin Stopford, Routledge, 1997.
2. H. I. Larvey, Ship Board Operations, Butterworth- Heinemann,1984.
3. Armstrong, Malcom, Practical Ship Handling, Brown Son&Ferguson, 1994.
4. Cylil Hughes, Ship Board Operation Problems, 1976.
5. Paul A. Samuelson, Economics, Tata McGraw Hill, 2005. :

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1504 MARINE INTERNAL COMBUSTON ENGINES-I (70 hrs)

MODULE I

Performance Characteristics of I.C.Engines: 4 –stroke and 2-stroke cycles; Deviation from Ideal Condition in actual engines; Limitation in parameters, Timing Diagrams of 2-stroke and 4-stroke engines. Comparative study of slow speed, medium speed and high speed diesel engines – suitability and requirements for various purposes. Mean Piston Speed, M.C.R & C.S.R ratings. Practical heat balance diagrams and thermal efficiency. -10hrs

General Description of I.C Engines: Marine Diesel Engine of M.A.N., Sulzer, B & W make etc., -4hrs

Constructional Details of I.C.Engines: Principal Components: Jackets and Liners, Cylinder heads, Pistons, Cross heads, connecting rods, Bed Plates, A-Frames, Welded construction for Bed Plates & Frames. Tie Rods. - 6hrs

MODULE II

Scavenging: Scavenging arrangements in 2-stroke engine; Air charging and exhausting in 4-stroke engines; Various types of Scavenging, their merits and demerits, Scavenge pumps for normally aspirated engines; under piston scavenging, Scavenge manifolds. -6hrs

Supercharging Arrangements: Pulse and constant pressure type; Their relative merits and demerits in highly rated marine propulsion engines. Air movements inside the cylinders. Turbocharger and its details. Two stage, un-cooled, radial turbochargers. -6hrs

MODULE III

Combustion of Fuels in I.C Engines: Grades of suitable fuels. Preparation of fuels for efficient combustion. Fuel atomization, Ignition quality, Fuel injectors and its details. Ignition delay, after burning. - 4hrs

Compression pressure and its effect on engines: Reasons for variation in compression pressure and peak pressure, Design aspects of combustion chamber. Control of NOX, SOX in Exhaust emission. - 4hrs

MODULE IV

Cooling of I.C Engines: Various Cooling media used; their merits and demerits, cooling of Pistons, Cylinder jackets & cylinder heads, Bore cooling, coolant conveying mechanism and systems, Maintenance of coolant and cooling system. - 5hrs

Safety and Prevention of Mishaps in I.C Engines: Causes and prevention of crank case explosions and Scavenge fires. Detection of the above and safety fittings provided to prevent damage. Uptake fire, Starting air line explosion. Thermal stresses. - 6hrs

Special features of I.C engines: Development of long-stroke Engines, implication of stroke – bore ratio, Development in materials in construction & heat treatment of M.E components. -3hrs

MODULE V

Forces and Stresses: Balancing, Overloading, Different type of vibrations & its effects, A/F vibration. -4hrs

Fuel pumps and metering devices: Jerk and Common Rail Systems; Fuel injection systems, helical grove and spill valve type Fuel Pumps. System for burning heavy oil in slow and medium speed marine engine, V.I.T & Electronic injection system. -6hrs

Effects of viscosity on liquid fuel combustion, Measuring equipment and its working principle, Necessity of variable fuel injection system, Procedure of application on a modern slow speed long stroke engine, Necessity for adoption of fuel quality setting system, Incorporation of FQSL along with the V.I.T system on the engine. -6hrs

References:

1. Harrington, Marine Engineering, SNAME, 1992.
2. A.Kane, Marine I.C.Engines, Shroff, 1984.
3. John B. Woodward, Low Speed Marine Diesels, Wiley, 1981.
4. C.C.Pounder, Marine Diesel Engines, Butterworth-Heinemann, 2009.
5. D.K.Sanyal, Marine Diesel Engines.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1505 MARINE AUXILIARY MACHINERY-II (75 hrs)

MODULE I

Steering gears: Operation and Constructional details of various types of steering machinery. Telemotor systems, transmitters and receivers. Variable Delivery Pumps used in steering gears, axial and radial displacement types. Hunting action of Steering gear. Emergency Steering arrangement. Safe Matic Steering Gear with redundancy concept as per SOLAS. Care and Maintenance of Steering Gear Plants. -8hrs

Shafting: Methods of shaft alignment, constructional details and working of Thrust blocks. Intermediate Shaft bearing and Stern tube bearing. Oil/ water lubricated Stern Tubes. Sealing Glands. Stresses in Tail End, Intermediate and Thrust Shafts. -6hrs

MODULE II

Dry Docking: Methods of dry docking of ships. Inspection and routine overhauling of underwater fittings and hull. Measurement of clearances and drops. Removal and fitting of propellers (with and without Key). -6hrs

Other Ship board equipments: Engine room crane, chain blocks, tackles, Anchor chain, its testing and survey requirements. Different types of ship stabilizer, Bow Thrusters, Hull Protection arrangements, Overhauling procedure for various Aux. M/c, Bad weather precaution taken, Maintenance of E.R. Stores etc.

Importance of LO/FO testing, Methods of testing etc. Use of oil mist detector. -10hrs

MODULE III

Noise and Vibrations: Elements of aerodynamic and hydrodynamic sound, Noise Sources on Ships and noise suppression techniques, Noise level measurement. Various modes of vibration in a ship (i.e. free, forced, transverse, axial and torsional – Their sources and effects), Resonance and critical speed, Structure borne and air borne vibration, Anti vibration mountings of machineries, De-tuners, Dampers with reference to torsional vibrations dampers, use of torsion graphs. -15hrs

MODULE IV

Pollution Prevention: Use of coalescers, baffles, grids. STOKES Law; Static and turbo separators, Oily bilge separators their construction and operation, Incinerators, Sewage Treatment Plant - various International requirements against marine pollution - MARPOL Convention, OLM & OCM, Introduction of IMO Conventions, regulation and rules. -12hrs

MODULE V

Lubrication: Theories of Lubrication, Types of Lubricants and their Properties Suitability of Lubricants for various uses; solid and fluid lubricants. Additive Oils and their specific use. Terminology used in Lubrication systems. Loading pattern of various bearings in marine use and Lubrication system adopted. Different types of bearings used for marine machineries. L.O. analysis & monitoring Engine report. -18hrs

References:

1. Smith D.W, Marin Auxiliary Machinery, Butter worth Publication, London,1983.
2. Khetagurov.M, Marine Auxiliary Machinery and Systems, MIR Publishing House, Moscow.
3. Denharto, Mechanical Vibration, McGraw Hill, 1956.

4. Kewel Pujra, Vibrations and Noise control,
5. Cowley, The Running and Maintenance of Marine Machinery, IME, 1992.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1506 MARINE ENGG. DRAWING (68hrs)

Drawing : Advanced Marine Machinery assembly drawings.

Part – I (Auxiliary Machine)

Marine machinery components are assorted stop & sluice valves and auxiliary equipment dismantled; to be conceptualized in assembly and laid out as working & functional parts. Sectional views in elevation & plans executed. Part sectional views depiction.

Part – II (Main machine)

Marine engine components dismantled. Assembled drawings of pistons, thrust blocks, liners, connecting rods, crossheads, injection valves, starting valves, Fuel pumps, Stern tube & Tail shaft, Rudder carrier bearing and all equipment with main machinery. Sectional / Outside and plan views of parts fitted / removed and in functional order.

References:

1. V. Lakshminarayanan & M.L Mathur, Machine Drawing-jain Brothers, N.Delhi,2007.
2. N.D. Bhatt, Machine Drawing, Charotar, 2006.
3. K.R. Hert, Engineering Drawing with Problems and Solutions,Edward Arnold,1975.
4. P.S. Gill, A text book of Machine Drawing, Kataria & Sons, 2001.

Type of Questions for University Examination.
One question each from Part-I and Part-II of 50 marks with options to answer A or B (2x50=100). A and/or B shall have sub-sections depending on the question.

MRE 1507 NAVAL ARCHITECTURE – I (70 hrs)

MODULE I

Function of the ship: Design and integration of ship systems, General lay out of the ship. -4hrs
Ship Types : Tankers, Bulk Carriers, Container Ships. LNG, LPG and Chemical Carriers, Lash Ships, Passenger Ships, Dredger, Tugs, etc. – Constructional details and requirements. -8hrs

MODULE II

Geometry of Ship & Hydrostatic Calculations : Ships lines, Displacement Calculation, First and Second moment of area, Simpson's rules, application to area and volume, Trapezoidal rule, mean and mid-ordinate rule, Chebycheff's rule and their applications, Tones per Cm. Immersion, Co-efficient of forms, Wetted surface area, Similar figures, Centre of gravity, effect of addition and removal of masses, Effect of suspended mass. - 20hrs

MODULE III

Transverse Stability of Ships : Statical stability at small angles of heel, Calculation of B.M. Metacentric height, Inclining experiment, Free surface effect, Stability at large angles of heel, curves of statical stability, dynamical stability, Different Characteristic curves of Dynamic stability. AITC formula. - 10hrs

MODULE IV

Longitudinal Stability and Trim : Longitudinal BM, MCT1, change of L.C.B. with change of trim, Change of trim due to adding or deducting weights, change in draft & trim because of filling/flooding several tanks with different densities, alteration of draft due to change in density, Flooding calculations, Floodable length curves, M.O.T. method for determination of floodable lengths, factors of subdivision, Loss of stability due to grounding, Docking stability, Pressure on Chocks. - 18hrs

MODULE V

Resistance & Powering: Frictional, Residuary and total resistance, Froude's law of comparison, Effective power calculations, Ship's correlation Factor (SCF), Admiralty coefficient, Fuel coefficient, and fuel consumption, Effect of viscosity and application of ITTC formula.
– 10hrs

References:

1. Muckle, Naval Architecture for Marine engineers, Newnes- Butterworth, 1975.
2. Tupper E, Introduction to Naval Architecture, Butterworth- Heinemann, 2013.
3. Comstock, Principles of Naval Architecture, Society of Naval Architects, 1990.
4. Lewis, Principles of Naval Architecture, SNAME, 1988.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1508 BOILER CHEMISTRY AND HEAT ENGINES LABORATORY (64 hrs)

(A) BOILER CHEMISTRY LABORATORY (24 hrs)

To determine hardness content of the sample of boiler water in PPM. – in terms of $CaCo_3$.
To determine Chloride content of the sample of water in PPM. in terms of $CaCo_3$.
To determine Alkalinity due to Phenolphthalein, Total Alkalinity and Caustic Alkalinity of the sample of water in PPM.
To determine Phosphate Content of the sample of water.
To determine dissolved Oxygen Content of the sample of water.
To determine Sulphate content of the given sample of water.
To determine Ph-Value of the given sample.

(B) HEAT ENGINES & HEAT TRANSFER LABORATORY (40hrs)

To determine the absolute Viscosity and Kinematic Viscosity of oils by Red Wood viscometer
To determine the flash point and fire point of a given sample of oil.
To determine the percentage of CO_2 , CO and O_2 in the flue gases.
To determine the Calorific value of the fuel with the help of Bomb Calorimeter.
To conduct load test on a two stroke single cylinder Petrol engine
To conduct load test on a two stroke single cylinder Diesel engine.
To conduct load test on a 4 stroke single cylinder Petrol engine.
To conduct load test on a 4 stroke single cylinder Diesel engine.
To conduct load test on a 4 stroke 4 cylinder Petrol engine.
To conduct load test best cooling on a 4 stroke twin cylinder Diesel engine.
To determine the Thermal conductivity of good conductors
To determine the Thermal Conductivity of Insulating materials
Heat transfer Through Fins or extended surface.
Heat transfer through Forced Convection.
Heat transfer through Natural Convection

MRE 1509 WORKSHOP PRACTICES - III (70hrs)

1. Welding Shop:
   Half V-welding (from top face)
   Full V-welding (from top face)
   Double V-welding (on opposite faces)
   Half U-welding (from top face)
   Double U-welding (on opposite faces)
   T-welding (on inner side)
   T-welding (both inner sides)
   T-welding (both outer sides)
   L-welding (outside corner)
   L-welding (inside corner)
   Angular welding (both sides)

2. General Overhauling Work:
   Dismantling, refitting and studying of a return-type and non-return-type valves.
   Overhauling of a Globe Valve and Sluice valve.
   Overhauling of a Steam stop Valve.
   Cutting of joints and packing for various uses.
   Cock Overhauling
   Shaft Overhauling
   Reciprocating Pump Overhauling
   Centrifugal Pump Overhauling
   Air Compressor Overhauling

3. Pipe repair and Fabrication.
4. Diesel Engine familarisation and Overhauling
5. Boiler familiarisation

MRE 601 MANAGEMENT SCIENCE (160 hrs)

MODULE I

Introduction to Management Principles & Practice: Definition and objectives of sound management. Need for Sound Management Principles and Practice & Growth of Modern management thought, Management functions, Process Planning, Corporation / Long term & tactical strategy, Policy distribution, SWOT Analysis, Organising – definition / illustrations, Staffing – manpower, planning, Directing – illustration, Controlling, parameters, application & Co-ordination; communication – efficient process model, communication barriers, inter-personnel communication skill. Principles of Locating a Plant & Developing Organization Structure, various types of organizational structures – Line / staff / matrix, centralization vs. decentralization of decision-making, distinction between authority / responsibility / accountability, Basic principles of delegation / empowerment of employees; Authority & Responsibility, Boundaries of Authority. -14hrs

MODULE II

Production / operation related uses: Distinction between products & services, Types of production system viz. Jobbing / Lot / Mass. Functions of Production Planning and Control, Product Development Principles, Standardization, Simplification & Specialization, Plant Layout, Product / Process, Logistics & supply chain / management. Integrated material management functions of material planning, inventory control, safety stock / cycle stock, purchase / stores performance, measurement parameters, standardization / codification, waste control. -10hrs

Introduction to Operations Research: Linear Programming, Distribution Methods, Network Technique in Management – Critical Path Method (CPM), Program Evaluation & Review Technique (PERT). -4hrs

MODULE III

Resources Allocation & Load smoothing: Operational Sales Forecasting; Inventory Control, Safety Stock, Determinational Introduction to Decision Theories in Management, Decision under Certainty, Right and uncertainty, Works Study, Job Evaluation & Merit Rating, Total Quality Management, Quality Control, ISO 9000 Series, Preventive/Condition based Maintenance and spare management. - 10hrs

MODULE IV

Finance Management: Methods of Capital formation & Control of Working Capital, How to read balance sheet / profit /loss, budgetary control &standard costing- Favorable/ adverse variances. Continuous & Discounted Cash Flow & Project Appraisal, Break even analysis, Cost Benefit Analysis, Methods of depreciation, Factory Costing, Estimating, Balance Sheet, Financial & Physical Ratios; Project & Budgetary control. -10hrs

MODULE V

H.R.D. : The personnel Function, Recruitment & Selection, Role of Psychological Tests in Recruitments, Training of employees, Performance Appraisal & counseling, Reward System, Legal Requirements and Regulation of Working Condition, Employer's Liabilities for Health and Safety, MBO, Leadership/Group Dynamics and Discipline, Motivation theories and Incentives, Maslow's hierarchy of contribution. Problems of Accident – Proveners, Fatigue etc. Relation with Trade, Union & Workers Participation in Management. -12hrs

References:

1. Koont S. O. Donnel, Principles of Management, Tata McGraw Hill, 2008
2. Bethel et. al, Industrial Organisation & Management, Tata McGraw Hill, 1962.
3. Prasanna Chandra TMH, Finance Management, 8th Edn.,2011. -
4. Hadley G, Linear Programming, Addision, Wesleys, 1962.
5. Samuel Eilon, Production Planning & Control, Universal Book Corpn. India.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1602 MARINE ELECTRICAL TECHNOLOGY (85 hrs)

MODULE I

Power Generation: Merits & Demerits board of A.C. & D.C. on board; Rules and Regulations governing electrical machineries on ships; Different alternator Excitations – Systems on board – (indirect, Direct 'static excitations, Brushless generator construction & operational diagram, Automatic Voltage Regulator. -9hrs

Alternative Source of Power: Emergency Generator & Different Starting method including auto-start, emergency batteries construction and its different types & duties, Location of emergency power, Different Emergency loads, Rules & Regulation, emergency power, Maintenance of emergency power source on board. Shore Supply – Specifications as per Voltage / frequency, precautions while taking shore supply. -8hrs

MODULE II

Distribution: Different electrical diagrams and their uses, electrical signals. Type of Distribution, Distribution network on board; Main & emergency switch board, construction, different switch gear & protective devices, Grounded and Insulated neutral systems, and precautions adopted in High Voltage distribution system, Cables & temperature classification. High Voltage systems- onboard requirements as per STCW 2010 Convention. – 10hrs

Motor & Control Equipments: Types of marine motor, types of enclosures, protective devices on motors, motor characteristics curves, sequential starting (e.g. Refrigerating plants, automatic fired boiler). -4hrs

MODULE III

Miscellaneous marine electrical equipment Alarm system: Engine Room Telegraph, Rudder Angle Indicator, R.P.M. & Revolution Counter, Centralised Salinity Indicator, Watertight door operation, Alarm system (types, supply) on board's oxygen analyzer, High & low level alarms, Navigational lights, Emergency Radio Operation, Electrical Deck auxiliaries. -12hrs

MODULE IV

Maintenance of Electrical Systems, Fault finding & Repair: Type of faults & indications on Generator, motor & distribution systems, Different Testing equipments & meters (multimeter / megger, clampmeter, etc.), Salvaging a motor Detection of faults on electronic circuits & cards – Indications & corrective arrangements, Necessary Precautions & care while fault finding and Repair, preventative maintenance, periodic surveys, spares requirement. -12hrs

Safe Electrical Practice: Safe watch-keeping, points to check on electrical machineries, Switch gears & equipments, microprocessor control and maintenance electrical fire fighting, precautions against electric shock and related hazards. -10hrs

MODULE V

Special Electrical Practice: Rules and Regulations & Operation of electro-hydraulic & Electric Steering gear, Diesel-electric and Turbo electric propulsion system, pod/Azipod drive unit, superconductivity applied in propulsion, Turbo alternator, special electrical practice for oil, gas and chemical Tankers (Tanker classification, Dangerous spaces, Hazardous zones, Temperature class), Flame proof Ex 'd' and intrinsic safety Ex 'i', Ex 'e' and Ex 'n' equipments and their

application in zones, Maintenance of Ex-protected apparatus. -20hrs

References:

1. G.O. Watson, Marine Electrical Practice, Butterworth, 1990.
2. W. Lows, Electricity Applied to Marine Engineering, IME, 1996.
3. D.A. Gillepie, Prime movers for generation of Electricity,IME,1974.
4. Reeds Series Vol. 7 , Advanced Electro Technology.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1603 SHIP FIRE PREVENTION & CONTROL (70 hrs)

MODULE I

Fire hazard aboard ships: Fire triangle, tetrahedron, Fire Chemistry, Spontaneous Combustion. Limits of inflammability. Advantages of vapors fire extinguishing agents including vaporizing fluids and their suitability for ship's use. Control of class A,B, C,D &E fires. -12hrs

MODULE II

Fire protection built in the ships: SOLAS convention, requirements in respect of materials of construction and design of ships, fire detection and extinction systems, fire tests, escape means, electrical installations, ventilation system and venting system for tankers. Statutory requirements fire fighting systems and equipment on different vessels. Fire doors and fire zones. -12hrs

MODULE III

Detection and Safety Systems: Fire safety precautions on cargo ships and tankers during working. Types of detectors, Selection of fire detectors and alarm systems and their operational limits. Commissioning and periodic testing sensors and detection system. Description of various systems fitted on ships. - 12hrs

MODULE IV

Fire fighting Equipment: Fire pumps, hydrants and hoses, Couplings, nozzles and international shore connection, Construction, operation and merits of different types of portable and fixed fire extinguishers installations for ships. Properties of Chemical used. Bulk Carbon Di-Oxide and inert gas systems. Fireman's outfit its use and care. Maintenance, testing and recharging of appliances. Preparation, Fire appliance survey. Breathing apparatus- types, uses and principles. – 14hrs

MODULE V

Fire Control: Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, Cargo holds, galley etc. Fire fighting in port and dry dock. Procedure for re-entry after putting off fire, rescue operations from affected compartments. First aid, Fire organization on ships. Fire signal and muster. Fire drill. Leadership and duties, Fire control and plan, Human behavior, Special precautions for prevention/fighting fire in tankers, chemical carriers, Gas carriers, Chemical carriers, Safe working practice. – 20hrs

Note: Lesson plan to comply with the latest requirements of IMO & SOLAS

References:

1. E. Gordon B & Alan C Parnell, Designing for Fire Safety, John Wiley, 1983.
2. V K Jain, Fire Safety, New Age International, 2007.
3. Denton, Safety Management, Tata McGraw Hill, 1982.
4. Krishnan N.V, Safety Management,ORS Publishers.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1604 MARINE INTERNAL COMBUSTION ENGINES-II (80 hrs)

MODULE I

Maneuvering Systems : Starting and reversing systems of different Marine Diesel engines with safety provisions. - 6hrs

Indicator diagrams and Power Calculations : Construction details of indicator instrument. Significance of diagram, Power Calculations, fault detection, simple draw cards and out of Phase diagrams. Power Balancing, Performance Characteristic Curves, Test Bed and Sea trials of diesel engines. -6hrs

Lubrication Systems : Lubrication arrangement in diesel engines including Coolers & Filters, Cylinder-Lubrication, Linear wear and preventive measures. - 3hrs

Combinations of lubricating oil, its effect and preventive measures: Improvements in Lubricating oils through use of additives, Types of additives, Monitoring engines through lubricating oil analysis reports. - 3hrs

MODULE II

Medium Speed Engines : Different types of medium speed marine diesel engines, couplings and reduction gear used n conjunction with medium speed Engine, development in exhaust valve design, V-type engine details. Use of poor quality residual fuels and their consequences. Improvements in designs for higher power output. Fuels, combustion process – fundamentals. - 10hrs

Automation in modern diesel engine plants : Remote operation, Alarm and fail safe system, Governors and their basic functions. Constant speed and Over speed governors. Constructional details and hunting of governor. Computerized monitoring and diagnostic applications in propulsion engines. The intelligent engine concept. Nox-Control of marine Diesel Engines. Improvement in designs for increased T.B.O. (Time Between Overhauls). - 8hrs

MODULE III

Maintenance of Diesel Engines : Electronic Governor, Inspection and Replacement of various component members such as Piston, Piston ring. Cylinder Head, Liner, Bearings Driving Chain and Gears etc. Crank shaft deflection and alignment, Engine holding down arrangements, Tightening of Tie bolts. - 6hrs

Trouble Shooting in Diesel Engines : Hot & Cold Corrosion, Crank shaft web slip, X-head bearing problems, microbial degradation in fuel & lub oil. - 5hrs

Modern trends in Development : Current Engines (Sulzer RTA, MAN B&W, NSD) Intelligent Engine (Camless concept), improvement in design for increased TBO. U.M.S. Operations of ships. Condition monitoring , Common rail fuel injection w.r.t electronic fuel injection , Exhaust emission and control – design of engine , NOx Technical file , IAPP certificate . - 5hrs

MODULE IV

Rotary positive Displacement Types of compressors: Compressed Air Motors. - 2hrs

Axial Flow Compressor: Principle of centrifugal compression and pressure rise in centrifugal compressor, change in Angular Momentum. Pre-whirl and pre-whirl vanes. Mach number at inlet to a centrifugal compressor, slip and slip factor, multi-stage centrifugal compressor. -10hrs

MODULE V

Gas Turbines Plants : Constant volume or Explosion cycle Gas Turbine plant, constant pressure cycle or Joule – Brayton cycle Gas turbine plant simple C-B-T cycle, condition for maximum

work output and thermal efficiency in simple cycle. Methods of improvement of Thermal Efficiency and work ratio of Gas Turbine plants. C-B-T-H cycle, complex cycles, closed cycle operation of Gas turbine plants, their merits and demerits. Total head or stagnation conditions. General Construction and Design features for marine plants, Materials of construction, Heat Exchangers and Reheat arrangements, Comparison of Free Piston engine gasifiers and conventional air-stream combustion chambers. - 12hrs

References:

1. Harrington, Marine Engineering, SNAME, 1992.
2. A.Kane, Marine I.C.Engines,
3. John B. Woodward, Low Speed Marine Diesels
4. C.C.Pounder, Marine Diesel Engines, Butterworth-Heinmann, 2009.
5. D.K.Sanyal , Marine Diesel Engines.
6. Southern, Marine Diesel Engines.
7 John Lamb, Running and Maintenance of Marine Diesel Engine.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

MRE 1605 MARINE REFRIGERATION AND AIR CONDITIONING (72 hrs)

MODULE I

Refrigeration : Reversed Carnot cycle, Vapour compression cycles, Refrigerating Effect, Co-efficient of performance, Cooling capacity, Rating of a Refrigerating Plant, Methods of improving C.O.P. Use of Vapour Tables, Applied Problems. Different refrigeration systems, classifications of refrigerators, uses of refrigeration at sea, cryogenic technology-definition, temperature range, insulation. – 10hrs

MODULE II

Marine Refrigeration Plants: Typical Marine Refrigerating Plants with multiple compression and Evaporator system. Heat pump cycles. Refrigeration in liquefied Gas carriers. -8hrs

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Different refrigerants: chemical formula, desired properties (general, physical, chemical, thermodynamic) comparison, effect on environment, Montreal protocol, new refrigerants. – 4hrs
Heat load calculation on refrigeration plant. – 2hrs

MODULE III

Design and construction of various components of refrigeration plants: compressor, condenser, evaporator, expansion valves, control and safety equipments. Operation and maintenance of refrigeration plants, control of temperature in different chambers, charging of refrigerant/oil, purging of air, defrosting methods, trouble shooting. - 12hrs
Refrigeration of cargo holds: brine system and it's operation & maintenance, methods of air circulation in holds, insulating materials, insulation, micro-organism, dead and live cargo, factors, affecting refrigerated cargo, container ship refrigeration, preparation for loading cargo, survey of refrigeration equipments. - 6hrs

MODULE IV

Properties of Mixtures of Gas and Vapours: Dalton's Law of partial pressure, Amagat's Law of partial volume, volumetric and Gravimetric analysis of Gas Mixtures, Gibb-Dalton's Law, mean value of a Gas Constant. Equivalent molecular weight, Density, specific volume, specific heat and Molar Heat Capacity of gas mixtures. Advanced problems on Adiabatic mixing. -8hrs

Air and Water Vapour Mixture: Specific humidity, Relative humidity, Dew point, unsaturated and saturated Air. Principle of Cooling Towers and Air Leakage Problem in surface condenser. - 6hrs

MODULE V

Principle of Air conditioning: psychometric properties of air comfort conditions, control of humidity, Airflow and A.C. Capacity calculation for ship plants. - 8hrs
Air conditioning: necessity on board ships, different systems, control of room, air temperature, humidity, noise, dust and purity. Construction of duct & diffuser, fans, ventilation of accommodation, fire safety balancing of system. - 6hrs
Ventilation: Ventilation of engine room, pump room, CO2 and battery rooms, air change requirements, design considerations, maintenance. Heat load calculation of air conditioning plant. – 2hrs

References:

1. Stoecker, Refrigeration and air-conditioning, TMH,1982.
2. C.P. Arrora, Refrigeration and air-conditioning, TMH, 1988
3. J.R.Stott, Refrigerating machines and A.C. Plant
4. Jordan and Prister , Refrigeration and air-conditioning, PHI, 1985
5. Ashare, Fundamentals and equipment(Guide and data book)- 4 Volumes
6. Smith D.W, Marine Auxiliary Machinery, Butterworth,1983.

Type of Questions for University Examination.
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MRE 1606 MACHINE DESIGN & DRAWING (60 hrs)

MODULE I

Procedure in Machine Design : Concepts of Design, Procedure & Processes, Design Synthesis, Economic consideration in Design, Feasibility, Preliminary Design Alternative, Final Design Alternative, Preliminary & Final Plans & Drawings. - 2hrs

Use of Standards in Design: Selection of preferred sizes, common useful Materials & Manufacturing considerations in Design. Review of failure criteria in Mechanical Design, Properties of Materials, Heat Treatment Processes, BIS System of Designation of Steels, Basis of Good Design, Deformation, Wear, Corrosion. Common useful Materials & Manufacturing considerations in Design. - 4hrs

MODULE II

Strength Consideration for Design : Strength of Materials, Reliability, Influence of size, Stress Concentration, Strength under combined stresses, Static loads, Impact loads, Repeated loads, Completely reversed loads, Static plus Alternating loads, Cyclic & combined loads, Fatigue Strength. Dynamic Stresses. Selection of Materials. -6hrs

MODULE III

Specifications : Fit, Tolerance, Finish-BIS - 4hrs

Design & Drawing to specifications for parts subjected to direct loads. – 6hrs

Fasteners : Bolts & Screws, Cotter & Knuckle joints, Keys & Couplings, Pipe joints.

Riveted & Welded joints: Design of riveted and welded machine parts. – 6hrs

MODULE IV

Power Transmission : Shafts & Axles, Bearings, Clutches & Brakes, Belt Drives, Chain Drives. - 16hrs

MODULE V

Design & Drawing of Tooth Gearing: Spur & Bevel Gears, Rack & Pinion, Worm & Worm Wheels, Helical Gears etc. - 16hrs

References:

1. J.E. Shigley, Mechanical Engineering Design, Tata Mc Graw Hill,2001.
2. V.L. Doughtie, Design of Machine Elements, McGraw Hill, 1964.
3. Siegel Maleev, Machine Design of Machines international text book co., 1965.

Type of Questions for University Examination.

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MRE 1607 NAVAL ARCHITECTURE - II (68 hrs)

MODULE I

Strength of Ships : Curves of buoyancy and weight, curves of load, Shearing force and bending moments. Alternate methods, Standard Conditions, Balancing ship on wave, Approximation for max. Shearing force and bending moment, method of estimating B.M. & Deflection. Longitudinal Strength, Moment of Inertia of Section, Section Modulus. - 14hrs

MODULE II

Propulsion & Propellers : Definitions, apparent and real ship wake, Thrust, relation between powers, relation between mean pressure and speed, measurement of pitch, Cavitation. -8hrs

Propeller types- Fixed pitch, Variable Pitch, Ring propeller, Kort nozzles, Voith Schneider propeller, Propeller theory. - 6hrs

Blade element theory, Law of similitude and model tests with propellers, propulsion tests, Geometry and geometrical properties of screw propellers, ship model correlation ship trials. - 6hrs

MODULE III

Rudder Theory : Action of the Rudder in turning a ship, Force on Rudder, Torque on Stock, Calculation of force torque on non-rectangular rudder angle of heel due to force torque on rudder, Angle of heel when turning. Types of Rudder, Model experiments and turning trials, Area and shape of rudder, position of rudder, stern rudders, Bow rudders. -14hrs

MODULE IV

Motion of Ship on Waves : Theory of waves, Trochoidal waves, relationship between line of orbit centres and the undisturbed surface, Sinusoidal waves. Irregular wave pattern, Wave spectra, Wave amplitudes, Rolling in unresisting media, rolling in resisting media, practical aspects of rolling, Antirolling devices, Forces caused by rolling and pitching, Heaving and Yawing. - 12hrs

MODULE V

Ship Vibration: Types of vibration, flexural vibration, tortional vibration, coupling, approximate formulae for frequency of vibration of a ship- prevention of vibration. -8hrs

References:

1. Muckle , Naval Architecture for Marine engineers, Newnes-Butterworth, 1975.
2. Tupper E, Introduction to Naval Architecture, Butterworth-Heinemann, 2013.
3. Comstock, Principles of Naval Architecture, Society of Naval Architects, 1990.
4. Lewis, Principles of Naval Architecture, SNAME, 1988.

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MRE 1608 FIRE CONTROL ENGINEERING LABORATORY (40 hrs)

Fire Engineering Lab Experiment

Testing and operation of jet and spray type nozzles and fire hoses. Operation, charging and maintenance of portable fire extinguishers.

a. Soda acid type.
b. Foam type.
c. Dry powder type.

Operation, Use and function of breathing apparatus.

a. Self contained type.
b. Bellow Type.

Use of fireman's outfit.

Study of working of lifeboat and provisions for lifeboat. Use of life jackets.

Construction and operational details of life raft giving importance to manual and hydrostatic release device.

MRE 1609 MECHANICAL LABORATORY (52 hrs)

Mechanics Experiments:

1. To measure circular and linear displacements of cam and follower in case of (i) Plate cam-Reciprocating follower (ii)Tangent cam-with roller oscillating follower and plot the displacement curves hence differentiate the velocity and accelerating curves.
2. To find the co-efficient of friction both for flat belt and V-Belt with Belt friction apparatus and hence find the slip.
3. Centrifugal clutch to demonstrate the process of Power parameters of the Hartnell Governor.
   i) Rotating masses
   ii) Spring Rate
   iii) Initial Spring compression.
4. Note the effects of varying the mass of the centre sleeve of the Porter Governor and Compare the same with that of Proell Governor.
5. To determine the characteristic curves of sleeve position against speed of rotation in case of :
   i) Hartnell Governor
   ii) Porter Governor and
   iii) Proell Governor
6. To determine the moment of inertia of different bodies by the Trifilar suspension by experiment and by calculation.

Vibration Experiments:

1. The following experiments in vibrations are performed with VIBLAB apparatus:

   i) To verify the relation $T = 2\pi\sqrt{(l/g)}$ in case of a simple pendulum and to plot the graph T Vsl.
   ii) To verify the relation $T = 2\pi\sqrt{((K_2 + OG_2)/(g\ OG_2))}$ in case of a compound Pendulum and find the radius of gyration and equivalent length of compound pendulum.
2. To determine the method of Torsional Oscillation, the radius of gyration of a body, about the centre of gravity by using the relation, $T = 2\pi (K/a)\sqrt{(L/g)}$
3. To verify the relation, $T = 2\pi\sqrt{(W/Kg)}$ and plot a graph T Vs W.
4. Study of undamped natural vibrations of a beam pivoted at one end supported by tension spring at the other end.
5. To find out the natural frequency of a beam with and without load and to verify the Dunkerley's Rule.
6. Study of forced vibrations for various amounts of damping of beam pivoted at one end and supported by tension spring at the other end and top plot a graph of amplitude factor Vs frequency ratio. (LONG .VIB).
7. To study the forced vibrations for various amounts of damping and to plot a graph of amplitude factor Vs frequency ratio (Lat.Vib.)
8. Prove experimentally $T = 2\pi\sqrt{(1/Kt)}$ and study the relationship between the periodical time and shaft length.

MRE 1701 SHIP-IN-CAMPUS TRAINING

FUNCTION – Marine Engineering at the Operational Level.

COMPETENCE- 1: Maintain a Safe Engineering watch (Table A-III/I)

Principles to be observed in keeping an engineering watch: Duties undertaken during watch, maintenance of machinery space logs, handing over watch, safety and emergency procedures, change over of remote/automatic to local control of all system, safety precautions to be taken and immediate actions to be taken in the event of fire or accident. -70hrs

Engine room resource management: Principles-allocation, assignment and prioritization of resources-effective communication-leadership and assertiveness- maintaining situational awareness-team building experience. -10hrs

COMPETENCE -3: **Use of internal communication systems onboard.** -10hrs

COMPETENCE -4: Operate main and auxiliary machinery and associated control systems:
Basic construction and operation principles of:
Boilers, shafting installations, propeller. – 46hrs

Other auxiliaries such as pumps, air compressor, purifier, fresh water generator, heat exchangers, steering gear, automatic control systems. -26hrs

Various deck machinery -62hrs
Safety and emergency procedures for operation of propulsion plant machinery. - 48hrs
Operation of other auxiliaries including refrigeration, air conditioning and ventilation systems. -25hrs

Competency as per table A-III/2:
Practical knowledge for start up and shut down main propulsion and auxiliary machinery and maintaining safety of the above. - 25hrs

COMPETENCE No-5: Operate fuel lubrication, ballast and other pumping systems and associated control systems: (Table A-III/I)

Operation of various routine pumping systems. -40hrs
Operation of bilge, ballast and cargo pumping systems and oily water separators: -45hrs

Competency as per Table A-III/2: Manage fuel, lubrication and ballast opearations:
-5hrs

FUCTION: Electrical, electronic and control engineering at the operational and management level:
COMPETENCE No.-6: Operate electrical, electronic and control systems (Table A III/1):
Basic configuration and operation principles of:
Electrical equipment- generators and distribution systems, preparing, starting, paralleling and changing over of generators. -18hrs
Electrical motors including starting methodologies. -64hrs

COMPETENCE No.-7: Maintenance and repair of electrical and electronic equipments (Table A- III/1):

Safety requirements for working on shipboard electrical systems, including safe isolation of electrical equipment required before personnel are permitted to work on such equipment, maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment, detection of electric malfunction, location of faults and measures to prevent damage. -52hrs

Operation of electrical testing and measuring equipment. -10hrs

Function and performance tests of the following equipment and their configuration:

Monitoring systems, automatic control devices, protective devices. – 8 hrs

Competency as per Table A-III/ 2:

Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.

Troubleshooting of electrical and electronic control equipment & monitoring systems. Function test of electrical, electronic control equipment and safety devices. -14hrs

FUNCTION: Maintenance & repair at the operational and management level:

COMPETENCE No.-8 Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair onboard (Table A-III/I).

Methods for carrying out safe emergency/temporary repairs- Safety measures to be taken to ensure a safe working environment and for using hand tools- machine tools and measuring instruments- Use of hand tools, machine tools and measuring instruments- Use of various types of sealants and packings. - 305hrs

COMPETENCE No. 9 : Maintenance and repair of shipboard machinery and equipment (Table A-III/ 1).

Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment- The use of appropriate specialized tools and measuring instruments. - 50hrs

Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment. - 120hrs

The interpretation of piping, hydraulic and pneumatic diagrams. - 25hrs

Competency as per Table A-III/ 2:

Manage safe and effective maintenance and repair procedures.
Detect and identify the cause of machinery malfunctions and correct faults.
Ensure safe working practices.

Planning maintenance & repairs including statutory and class verifications- Detection of machinery malfunction, location of faults and action to prevent damage Inspection and adjustment of equipment. Non-destructive examination. - 13hrs

FUNCTION : Controlling the operation of the ship and care for persons on board at the operational and management level.

COMPETENCE No. 10: Ensure compliance with pollution prevention requirements (Table A-III/ 1).

Precautions to be taken to prevent pollution of the marine environment- Anti-pollution procedures and all associated equipment- Proactive measures to protect the marine environment.
- 24hrs

COMPETENCE No. 11 : Maintain seaworthiness of the ship (Table A-III/ 1):
General knowledge of the principal structural members of a ship and the proper names for the various parts. - 10hrs

COMPETENCE No. 12 : Prevent, control and fight fires on board (Table A-III/ 1):

Ability to organize fire drills- Knowledge of classes and chemistry of fire- Knowledge of fire-fighting systems- Action to be taken in the event of fire, including fires involving oil systems.
- 24hrs

COMPETENCE No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any. - 3hrs

TOTAL = 1152hrs
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MRE 1801 SAFE WATCH KEEPING & ENGINE ROOM RESOURCE MANAGEMENT
(68 hrs)

MODULE I

Standards of training, certification and watch keeping for sea farers-International Conference of 1978 and modifications under STCW 1995 and 2010. Basic principles to be observed in keeping engineering watch requirements. -7hrs

Criteria for composing the engine room watch. Fitness for duty, Protection for marine environment, Requirement for certification, minimum knowledge requirement for certification, theoretical, practical duties and responsibilities concerning safety and protection and environment requirement for watch keeping duties. Physical training and experience in watch-keeping routine; main and aux. machines, pumping systems generating plant. Safety and emergency procedures, First aid. -8 hrs

MODULE II

Minimum requirement for Rating of Engine room watch. Special requirements for engineer officers for oil tankers, Chemical tanker, gas tankers, Details of operational guidance for in-charge of an engineering watch. -7 hrs

Engineering watch underway – general taking over watch, periodic checks of machinery, engine room Log, preventive repairs and maintenance, bridge notification. Navigation in congested water and during restricted visibility, calling the attention of the Chief Engineer officer, watch keeping personnel. -8hrs

MODULE III

Engineering watch (unsheltered anchorage) - condition to be ensured. Watch-keeping in port watch arrangements- Taking over and handing over a watch- Oil, Chemical and Gas tankers-principles, characteristics of cargo- toxicity hazards- safety equipments, protection of personnel pollution. -8 hrs

Shipboard Applications-Regulation and codes of practice for Chemical and Gas tankers, safe watch keeping –safety precautions to be taken on board those ships during ship operation, repair and maintenance, emergency operations; training of officers and other personnel- Requirement of continued updating of proficiency. -8hrs

MODULE IV

Leadership and team working skills:

Introduction to Management, Related Conventions and National Legislations, applies task and workload management, applies effective resource management and decision making.

Engine room resource management, effective corrections, allocation of resources. Planning and coordination, work load management, time and resource constraints. Personal relationship on board ship, working in multi cultural environment.

MODULE V

Leadership and Managerial Skills:

Knowledge of Shipboard Personnel Management and Training - Engineer and Manager, Human Resource Management, Training and Development, Maintenance Management.

Ability to Apply Task and workload management – Communication, Team building, Planning and co-ordination, Personal assignments, Time and resource constraints, Prioritization.

Knowledge and ability to apply effective Resource Management - Allocation, assignment and prioritization of resources, Effective communication on board and ashore, Decisions reflect consideration of team experience.

Knowledge and ability to apply Decision-Making Techniques - Management processes and functions, Negotiating skills, Situation and risk assessment, Identify and generate options, Select course of action, Evaluation of outcome effectiveness.

Development, Implementation, and Oversight of Standard Operating Procedures - Project planning and controlling. -22 hrs

References:

1. STCW Convention Proceedings 1978, 1995 and 2010 Amendmends
2. M'Notices
3. Robert B.Madduc, Team Building,Crisp Publications, 1985.
4. D.K.Tripathi, Team building and leadership: With Texts and Cases, Himalayan Books,2011.
5. Uday Kumar Haldar, Team building and Leadership, Oxford University press,2011.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1802 SHIP OPERATION AND MANAGEMENT (74 hrs)

MODULE I

Brief history shipping: Modern shipping practice, Marine vehicles and cargoes, Development in shipping and cargo handling, multi model transportation, factors affecting universal adoption, liner and tramp shipping services. -4 hrs

Conference systems. Organization & concerns, shippers council, Chartering, chatter parties, Theory of freight rates and fares. Rate fixation machinery and government control. Responsibility of ship owners and charters, Tanker chartering, freight rates and fares- various influencing factors for market pricing. -4 hrs

Bills of lading-function & uniqueness and related problems, Carriage of Goods by Sea Act, Cargo surveys and protests. -6 hrs

MODULE II

Marine insurance: underwriting and loss adjusting principles applied to Marine cargo insurance. Hull/machinery policy, Particular average, General average, P and I Clubs, making claims. -10hrs

Shipping companies-organization structure, restructuring on the basis of functional coherence, ship management companies. Turn around strategy for sick shipping companies, Ownerships of vessels, Shipping Company and its administration. -10 hrs

MODULE III

Capitalization and finance, characteristics, cost ratios & allied definition. Sources, Financing package, Lender security, Relation between Insurance Premium, & non-conformity / condition of class. Economics of new and second hand tonnage, Subsidies, procedure & implication of buying & selling new/old vessels. -8 hrs

Ship Operations: planning sailing schedules, Voyage estimates. Economic factors. -6hrs

Commercial Shipping practice: Manning of ships, Engagement and discharge of crew, D.L.B Seaman's welfare. -4 hrs

MODULE IV

Merchant shipping act: Registration of ship, ship's papers, Port Procedures, Pilotage, flags of convenience, flags of discrimination, and their effects on shipping, duties regarding pollution, Collision, Explosion, fire etc., Vessels in distress, Shipping causalities penalties under merchant Shipping Act. -12hrs

MODULE V

Maritime Declarations of Health and the requirements of the International Health regulations including WHO's guidelines for drinking water quality. -3hrs

Marine fraud: Genesis and prevention. -3 hrs

Indian shipping: current scenario and few case studies. -4 hrs

References:

1. G.Raghuram, Shipping Management- Cases and concepts, 2008.
2. Larvey, Ship Board Operation, Butterworth- Heinmann, 1984.
3. Amstrong Malcom.C, Practical Ship Handling, Brown Ferguson, 1994.
4. Stevens, Shipping Practice , Sterling Book house, 2004.
5. John M. Downard, Managing Ships , Fairplay Publication, 1984.
6. Capt.Dara E. Driver, Advanced Shipboard Management, fairplay Publication, 1990.
7. G. Raghuram, Shipping Management, Vasant J.Sheth Memorial Foundation, 1992.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1803 MARINE MACHINERY SYSTEM DESIGN (90 hrs)

MODULE I

Design Considerations: Manufacturing methods, Castings, Forgings, Fabrication & Plastic moulding. Machine tolerances and surface finish. Application to basic design principles in respect of function, available materials, production methods, economics, aesthetic appeal. Initial and servicing cost, analysis of force, flow through an assembly and its effect on the design. Design with respect to repairs and reconditioning specifically 'at sea' work with its normal limitations and restrictions. -18 hrs

MODULE II

Marine Machinery Component Designs & Drawing :-

Design and Drawing of marine machinery components subject to combined bending, twisting and direct loading like Crank shafts, Propeller shafts etc., Design and Drawing of Flywheel, Piston, connecting rod, Safety valves, Reducing valves, Compression & Torsion springs, Journal Bearings, Thrust bearings etc. Design of lifting equipment e.g. Engine room overhead crane, globe & other valves Mechanical Pilot etc. -15 hrs

MODULE III

Advanced Design of Marine Systems Design & Drawing :-

Power Transmission system including thrust blocks, intermediate shaft and tail end Shaft. Water cooling systems including pumps, filters, heat exchangers for Diesel and Steam engine plants. -16 hrs

MODULE IV

Advanced Design of Marine Systems Design & Drawing :-

Lubricating Oil systems including pumps, purifiers pressure by-pass valves.

Electro-hydraulic Steering gear system including Rudder, Rudder stock, Tiller arm, Ram &Cylinder Marine Diesel Engine Air starting systems including Air receivers, Compressors and Air starting valves. -16 hrs

MODULE V

Advanced Design of Marine Systems Design & Drawing :-

Marine Diesel Engine Scavenge and Exhaust system. Marine Diesel Engine Fuel Injection system including Fuel pumps and Fuel injectors.

Design of Steam Turbine Plants. Design of Gas Turbine Plants.

Life boat and it's launching device. Refrigeration Plant. Bulk CO_2 system.

Fire fighting system including emergency fire pump. -16hrs

Computer Aided Design :

Analysis of stress, strain, vibration, thermal stress, deflection through method of Finite Element Analysis by use of various software like MSC, NASTRAN, I-DEAS, AUTO-CAD, Pro-engineer (Practice only). -9hrs

Note :- Latest developments and IMO requirements are to be considered in lesson plan.

References:

1. J.E. Shigley, Mechanical Engineering Design, Tata Mc Graw Hill, 2001.
2. V.L. Doughtie, Design of Machine Elements, McGraw Hill, 1964.
3. Siegel Maleev, Machine Design of Machines, international text book co.,1965
4. N.D. Bhatt, Machine Drawing, Charotar, 2006.
5. J.N. Reddy , Introduction to Finite Element Method, Tata Mc Graw Hill, 2005.
6. Segerlind, Finite Element Analysis, Wiley, 1984.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1804 MARINE CONTROL ENGG. & AUTOMATION (75 hrs)

MODULE I

Measuring Devices: Pressure, Temperature, Level and Flow measuring devices. Miscellaneous Instruments; Shaft Power meters, Unbonded Strain Gauges, Bonded Strain Gauges, Troductor, Tachometers (Electric and Mechanical), Water Purity Meters: Salinity Indicator, P H Meters, Oil in Water Monitor: Photo Electric Cells, Photo Conductive Cells, Photo Voltaic Cells, Viscosity Sensors, Oil Most Detector -8hrs

Signal Transmitting Devices: Flapper Nozzle, Electro Pneumatic signal converter, Electrical signal transmission. Pneumatic, Types of Controllers: hydraulic, electric and electronic controllers for generation of control action, Variable Inductance and capacitance transducer, Force Balance Transducer, Synchros. -8 hrs

MODULE II

Automatic Control Theory: Process Control, Feed Back, Closed Loop and Open Loop Control, Two Step (On-Off) Control, Modulating Control, Off Set or Droop, Desired Value, Set Value, Proportional, Integral and Derivative Control, Split Range, Ratio and Cascade Control, System Response: Distance Velocity, Measurement and Transfer Lags. -8hrs

Automatic Controllers: Functions of a Proportional, Integral and Derivative Action Controllers, Stacked Type, Electronic, and Pulse type Controllers, Controller Adjustments Relays, On-Off, Cut Off Switches. -8hrs

MODULE III

Correcting Units: Diaphragm actuators, Valve-positioners, piston actuators, Electro-pneumatic transducers. Electro-hydraulic actuators and Electric actuator control valves. -8 hrs

System analysis: Examination of system behaviour as a result of different inputs with respect to time or frequency response. -3 hrs

Mathematical Models: System behaviour considered in a mathematical sense using Differential Equation. System description using mathematical terms for Mechanical, Electrical, Thermal and Liquid Level system.

Laplace Transforms, Transfer Functions and Block Diagrams. -10 hrs

MODULE IV

.**Stability and Performance:** Concept of stability, Routh & Hurtwiz stability criteria. Analysis of System Performance under dynamic or transient operating condition using Laplace Transforms. Performance characteristics, Nyquist stability criterion. -12hrs

MODULE V

Application of Controls on ships: Marine Boiler-Automatic Combustion control, Air/fuel ratio control, feed water control two and three element type, steam pressure control, combustion chamber pressure control, fuel oil temperature control, Control in Main Machinery units for Temperature of lubricating oil, jacket cooling water, fuel valve cooling water, piston cooling water and scavenge air, fuel oil viscosity control, working of control system during Manoeuvring of Direct Reversing Diesel Engine Bridge control of main machinery. Instrument for UMS classification. -10hrs

References:

1. G.J. Joy and I.D. Gardner , Instrumentation and Control.
2. Werner Deport & Kurt Stoll, Pneumatic Control, Vogel- Verlag, 1975.
3. Werner Deport & Kurt Stoll, Pneumatic Control Application.
4. Application of Automatic machine and alarm equipment on ships part-iv Vol. I, IME.
5. Leslie Jackson, Instrumentation and Control systems(Reed's Vol-10).
6. L.F.Adams, Engineering Instrumentation and Control, Hodder Arnold, 1981.
7. Terry L.M. Bartelt, Industrial Electronics, Thomson Learning, 1997.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE-1805 MARITIME STATUTORY REGULATIONS (72Hrs.)

MODULE I

IMO and its structure and functions- IMO Conventions and Recommendations and how above instruments are adopted under Explicit/Tacit acceptance procedures.

UNCLOS: knowledge of the international maritime law embodied in UNCLOS.

SOLAS: Basic safety concept on board a merchant vessel, understanding the contents, and having the operational knowledge of them.

Understanding the importance and having the operational knowledge of LOADLINE Convention, 1966, TONNAGE Convention, 1969, COLREG, 1972 with respect to ship's safety. -16hrs

MODULE II

ISM Code: Introduction-background-objectives-implementation-Mandatory applications of SMS- Various requirements of ISM code- Documentation- Maintenance of ship equipments as per the code- company's verification, review and evaluations –Certification, verification and control- internal and external audits- issue of DOC/SMC certificates and maintenance of them.

ISPS Code: Security awareness – identification of security threats – security related duties – ISPS Code and its requirements- ship's security plan – levels of security – controlling measures – drills and exercises – documentation – audits and certification. -14hrs

MODULE III

Pollution related Conventions, Acts and regulations:-Precautions to be taken to prevent pollution of the marine environment during bunkering, loading/discharging oil cargo, tank cleaning, pumping out bilges.

MARPOL 73/78: Responsibilities under the relevant requirements of the International Convention for the prevention of Pollution from Ships – Annex I, Annex II, Annex III, Annex IV, Annex V and Annex VI of MARPOL- Various equipments requirements, their operations, documentation, including necessary record books to be maintained under each of the said Annexes.

Requirements of the International Convention for the Control and Management of Ship's Ballast Water and Sediments,2004, international Convention for the Control of Harmful Anti-Fouling Systems on Ships,2001, Regulation on Noise, Oil Pollution Act, 1990.

Concept of Liability and Compensation as related to Marine Pollution. -18hrs

MODULE IV

ILO's Maritime Labour Convention,2006 (MLC 2006): Need for this- requirements of the convention- Documentation – Certification- Maintenance of certificates issued under MLC. -8hrs

MODULE V

National Legislation: How national legislations are made from international conventions- Merchant Shipping Act, 1956 and its amendments- Role of Maritime Administration (Directorate General of Shipping)- and its functions, DGS Rules, MS Notices. Verification of Compliance of various international conventions and national legislations- Flag State Inspections- Port State Control Inspections- Non conformities – Detention of ships.

Statutory and Classification surveys- related conventions for the certificates- Surveys special/intermediate/annual to be conducted on ocean going ships-period of validity and maintenance of them.

RPS rules and their requirements. -16hrs

References:

IMO and ILO publications on the above said conventions, DGS regulations, Class Rules.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

ELECTIVE
MRE 1806 (A) DOUBLE HULL TANK VESSELS (72 hrs)

MODULE I

Origin of double hull ships, their usefulness and superiority over conventional single skin ships, use of double hull tank ships for transport of different types of commodities, prevention of oil-spill and pollution of sea, IMO requirements, schedule for phasing out single hull tank vessels of different sizes.

MODULE II

Design considerations, main dimension, hull-weight estimate, double hull requirements, minimum depth of double bottom tank, wing tank width, clearance for inspection, etc. maximum cargo tank size, capacity, effect of free surface, damage stability, hydrostatically balanced loading, sloshing loads, its elimination or minimization.

MODULE III

Structural design, non-uniform and uniform stress distribution, unidirectional (longitudinal) structural members, elimination of transverse structural members (except transverse bulkheads), minimization of structural discontinuities and stress concentration zones, use of steel of higher strength, resistance to grounding and collision, classification society requirements, access to inside and bottom spaces.

MODULE IV

Cargo handling system, use of submerged pumps, ordinary pumps or new independent pumps, cargo transfer system, assurance of different grades of oil, concealed pipe-lines, easy maintenance, inspection and cleaning, elimination of explosion risks.

MODULE V

Economic aspects, fast loading discharging of oil cargo, quicker and cleaning, ballasting and deballasting, larger number of trips per year.

References:

1. D.J. Eyres, Ship construction, Elsevier, 2007.
2. Taggart, Ship Design and Construction, SNAME, 1980.
3. Muckle, Strength of Ship Structure, Edward Arnold, 1967.
4. D.A. Taylor, Merchant Ship Construction, IME, 1992.
5. Ed. Lewis, Principles of Naval Architecture Vol. 1, 2, & 3, SNAME, 1988.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

ELECTIVE

MRE 1806 (B) ADVANCED MARINE HEAT ENGINE (CO-CYCLES) (72 hrs)

MODULE I

Complex Heat Engine Plants:-

Combined Steam Turbine and Diesel Engine Cycles. Combined steam Turbine and Gas Turbine cycles. Combined Gas Turbine and Diesel Engine cycles/Plants. Different Methods of Improving the Overall Thermal Efficiency of the entire plant.

MODULE II

Design of the most optimum condition and combination of complex plants. Cascade Refrigeration plants. Free piston Gas Generators.

MODULE III

Turbo Blowers and Turbo Compressors:-

Compressor Characteristics for Axial Flow compressors and Centrifugal Compressors. Stalling of compressors. Turbine characteristics, Matching of components like compressor and Turbine. Performance of different units in combination in single shaft arrangement.

MODULE IV

Combustion and Flame stabilization:-

Combustion of liquid Fuels, Atomization, mixing, combustion cure and different methods of Flame stabilization, Design& Combustion chamber. Spray of Fuel, Pre-mixing of Gaseous Fuels for combustion, Stability of the Flame.

MODULE V

Design of different types of compact Heat Exchangers for different Applications, e.g. Air preheater, Gas and Oil Heaters etc.

References:

1. M.I. Malleve, Internal Combustion Engine
2. Holman, Heat Transfer, McGraw Hill, 2009.
3. Obert, IC Engines & Combustion
4. Taylor, Introduction to Marine Machinery, Butterworth-Heinemann, 1996.
5. Kern, Process heat transfer, McGraw Hill, 2001.
6. Yahya .S.M, Turbomachines, Tata McGraw Hill, 2010.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

ELECTIVE

MRE 1806 (C) FLUID CIRCUITS & CONTROL (72 hrs)

MODULE I

Introduction – Historical background- System components and functions: Valves, Tank, Flexible hose, piping and fittings. Seal and packing, actuators, pipe couplings, Assembly of different hydraulic components without using piping, e.g. Vertical/Horizontal stacking, manifold block etc. Different types of filters, instruments and control elements, e.g. Float switch, thermostat, pressure switch, etc. Different valves for pressure control, velocity and discharge control direction control, etc. Symbols of components along with various hydraulic terms.

MODULE II

Different control systems, Hydraulic and Pneumatic systems, Typical circuit for a pump set, Advantages of fluid circuit.

Fluid for hydraulic and pneumatic control; properties of liquids for hydraulic control, hydraulic reservoir, properties of air for pneumatic control, reservoir for compressed gases and compressed air, Compressibility and Inertia loading, Hydraulic stiffness, System natural frequency and allied problems.

MODULE III

Fluid power units:- Pumps, compressors and blowers, Positive displacement pumps: reciprocating pump, gear pump, vane pump screw pump, rotary piston pump: Pressure accumulators and intensifiers.

MODULE IV

System Circuits – Linear circuits, regenerative, circuits, accumulator circuits, intensifier circuits. Open loop and Closed loop systems, block diagram, application of Laplace transform, transfer function, Characteristic equation different physical systems of first order and second order, spring-mass damper systems Liquid level systems, thermal systems etc. systems of nth order.

MODULE V

Stability of a system – Root locus methods, Rouths criterion, Fluid logic and control systems.Application of hydraulic control in machine tools and other devices.

Hydraulic Systems – Hydraulic press, Hydraulic crane, hydraulic lift, hydraulic riveter etc. Hydraulic systems – Fluid coupling and fluid torque converter.

References:

1. John Pippenger and Tyler Hicks, Industrial Hydraulics, Tata Mc Graw Hill Ltd.,1980.
2. S.R.Majunder, Pneumatic Systems- Principles and Maintenance, Tata McGraw Hill Publishing company Ltd.,1995.
3. Andrw Parr, Hydraulics and Pneumatics, Butterworth-Heinemann,1999.
4. James F.Thorpe, Mechanical System Components, Allyn and Bacon Publishers, 1989.
5. Bruce E.Mccord, Designing pneumatic control circuits, Marcel Dekker Inc., 1983.
6. Pelter Rohner, Industrial Hydraulic Control, Prentice hall, 1987.
7. Herbert E. Marrit, John Wiley, Hydraulic Control System, Dekker Inc.,1983.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

ELECTIVE
MRE 1806 (D) ADVANCED HYDRAULICS (72 hrs)

MODULE I

Hydraulic Transmission of Power - Hydraulic Motors, Valves, Types of Hydrostatic drives. Types of Hydraulic Transmission Systems-Multimotor open-circuit Systems and closed-circuit systems. Applications of Hydraulic Transmission, Advantages and disadvantages of Hydrostatic transmission.

MODULE II

Rotodynamic Transmission- Hydraulic Coupling, Torque converter and characteristics of hydraulic coupling and Torque Converter. Linear Transmission of Hydraulic Power, Circuit for devices like Hydraulic Press, Jack, Accumulator, Intensifier and Hydraulic lift.

MODULE III

Fluid Power- Introduction, Application of Control Systems, Control Signals Hydraulic Servo mechanisms, Servo valves, valve operated servomechanisms and Pump controlled servomechanisms.

MODULE IV

Fluidics -Introduction and definition, Terms used in fluidics, efficiency of a fluidic device, Digital devices and analog devices.

MODULE V

Stability of a system – Root locus methods, Rouths criterion, Fluid logic and control systems. Application of hydraulic control in machine tools and other devices.

References:

1. John Pippenger and Tyler Hicks, Industrial Hydraulics, Mc Graw Hill Ltd., 1980.
2. S.R.Majunder, Pneumatic Systems- Principles and Maintenance, Tata McGraw Hill Publishing company Ltd., 1995.
3. Andrw Parr, Hydraulics and Pneumatics, Jaico Publishing House,2011.
4. CMTI, Machine Tool Design Hand Book ,Tata McGraw Hill company.
5. James F.Thorpe , Mechanical System Components, Allyn and Bacon Publishers, 1989.
6. Bruce E.Mccord, Designing pneumatic control circuits, Marcel Dekker Inc., 1983.
7. Pelter Rohner, Industrial Hydraulic Control, Prentice Hall, 1987.

Type of Questions for University Examination.

Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).

Both A and B shall have a minimum of two sub-divisions.

ELECTIVE

MRE 1806(E) RENEWABLE ENERGY SOURCES & APPLICATIONS (72 hrs)

MODULE I

Principles of Renewable Energy: Introduction, Fundamentals, Scientific Principles of Renewable Energy. Technical Implications, Social Implications.

Solar Radiation: Introduction, Extra terrestrial Solar Radiation, Components f Radiation, Geometry of Earth & Sun, Geometry of the Collector, Solar Beam.

Effects of Eastern Atmosphere, Measurement. Estimation of Solar Radiation, Problems.

Solar Water Heating: Introduction: Heat Balance, Unsheltered & Sheltered Heaters, Systems with Separate storage. Selective Surfaces, Evacuated collectors, Uses of Solar Heat, Air Heater, Space Heating & Cooling, Water desalination, Solar Ponds, Solar concentrators Electrical Power systems, Problems.

MODULE II

Photo Voltaic Generation: Silicon P-N Junction, Photo absorption, Solar Radiation Input, Photo Voltaic Circuit Properties & Lads, Limit to Cell efficiency. Solar Cell Construction, Types & adaptation of Photo voltaic. Other types of Photo voltaic & thermoelectric Generation, Problems.

MODULE III

Wind Power: Introduction: Turbine Types & Terms, Linear Momentum & Basic Theory, Dynamic Matching, Stream Tube Theory, Characteristics of the Wind, Power Extraction by a Turbine, Electricity Generation, Mechanical Power, Total systems, Problems.

MODULE IV

Wave Energy: Tidal Power: Introduction, The cause of Tides, Enhancement of Tides, Tidal Flow Power, Tidal Range Power, World Range Power sites, Problems.

Ocean Thermal Energy Conversion:

Principles, Heat Exchangers, Pumping Requirements, Other practical considerations, Problems, Hydro Power & Geothermal Energy. Brief Review & Description

Energy storage & Distribution: Importance of Energy Storage & Distribution, Biological Storage, Chemical Storage, Heat Storage, Electrical Storage, Fuel Cells, Mechanical Storage, Distribution of Energy Problems.

MODULE V

Biomass: Principles of using Biomass, Availability, Economics, Biofuels Introduction Biofuel Classification, Thermo chemical, Biochemical, Agrochemical Biomass Production for energy farming. Energy farming-advantages & disadvantages, Geographical Distribution, Crop yield, Energy analysis, Direct combustion for heat, Domestic cooling & heating, Crop drying, Process heat & electricity. Pyrolysis, Solid, Liquid, Gases Hydrogen Reduction, Acid & enzyme hydrolysis, Conversion of oil (coco) to Ester, Methanol liquid Alcoholic fermentation, Directly from sugar cane sugar Beet, Starch crops, Cellulose, Ethanol fuel use. Ethanol production.

Anaerobic Digestion for Biogas-Basic process & energetics Digester sizing. Working Digesters, Agrochemical fuel Extraction-advantages & disadvantages.

References:

1. G.D. Rai, Non Conventional Energy Sources, Khanna publications,1999.
2. H.P. Garg & Jaiprakash, Solar energy, TMH, 2005.
3. Archie W.Culp, Principles of energy conservation, TMH,1990.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

ELECTIVE
MRE 1806 (F) ADVANCED FLUID MECHANICS (72 hrs)

MODULE I
Hydraulic Transmission of Power:
Hydraulic pumps: -
Gear, Screw, Vane pumps of fixed and variable displacement types, Axial piston pumps of fixed and variable displacement types-Swasplate and Bent Axis Design: Radial piston pump.

MODULE II
Hydraulic Accumulators:
Various types-weight, spring or gas loaded, different principles-piston, bladder of diaphram type, Change of condition of the fluid in a loaded accumulator-Adiabatic, Isothermic, Polytropic, Flow graph, sizing, pressure setting and the economics.

MODULE III
Hydraulic Rotary Motors:
Fixed or Variables displacement type, axial piston unit. Of Swash plate and bent axis design, fixed displacement axial piston unit of wobble plate design, Vane type.

MODULE IV
Rotodynamic Transmission:
Fluid Coupling, Hydraulic Torque Converter their characteristics, Hydraulic Rotary Actuator of parallel piston type and piston type with rack-pinion, crank lever mechanism.

MODULE V
Stability of a system – Root locus methods, Rouths criterion, Fluid logic and control systems.Application of hydraulic control in machine tools and other devices.

References:

1. Daugherty and Franzini, Fluid Mechanics with Engineering Applications, International Student Edition, Tata McGraw Hill,1997.
2. B.S.Massey, Fluid Mechanics, Routledge, 2005.
3. K.L.Kumar, Engineering Fluid Mechanics, S.Chand & Co.,2008.
4. Rajput, Fluid Mechanics & Mechinery, S.Chand Publishing house, 1998.
5. Streeter, Applied Fluid Mechanics,TMI,1966.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

ELECTIVE
MRE 1806 (G) TRIBOLOGY (72 hrs.)

MODULE I

Dry Friction – topography of surfaces – contact between surfaces – sliding friction – energy dissipation. Theory of molecular attraction – fretting corrosion and prevention – variables in dry friction – present concept of friction – boundary friction – oiliness – variables of boundary friction – friction characteristics of metals and non-metal – rolling friction – sources of measurement of friction.

MODULE II

Wear – types – mechanism – factors affecting wear – Adhesive wear – abrasive wear – fatigue wear – corrosive wear – brittle fracture wear – Delamination – Wear measurement.

MODULE III

Viscosity and flow; Fundamentals of viscosity and flow – Petroff's equation – friction torque – viscosity measurement – factors affecting viscosity – Principle of hydrostatic lubrication – hydrostatic step bearing – multi recess bearing – design problems – different types of compensation and their effect on bearing, parameters – hydrostatic lift, simple problems – hydrostatic journal bearing, simple problems – hydrostatic squeeze films.

MODULE IV

Hydrodynamic Lubrication: solution of Reynolds equation – application to tilting pad thrust bearing – design of hydrodynamic journal bearings – force feed on oil flow with various type of grooves – dynamic bearings and rotor systems – brief discussion, lubrication systems, bearing materials – gas bearings – brief discussion – elastohydro dynamic lubrication – brief discussion.

MODULE V

Lubricants and Maintenance: Lubricants – types – solid and liquid – properties - additives – testing – reclamation of lubricants, surface treatment – phosphating of metal surface, Teflon coating, - Predictive maintenance – signature analysis and condition monitoring – basic principles – instrumentation.

References:

1. Cameron, A, Basic Lubrication Theory, 3rd Edition, Wiley Eastern, 1988.
2. Majumdar, Introduction of Tribology of bearings, 1st Edition, Prentice – Hall international,1986.
3. Hutchings. M.Tribology, Friction and wear of Engg., 1st Edition, Edward Arnold, Great Britain, 1992.
4. Bharat Bhusan & B.K.Gupta, Handbook of Tribology, Tata McGraw hill, 1991.

Type of Questions for University Examination.
Two questions A and B of 20 marks from each module with options to answer A or B (5x20=100).
Both A and B shall have a minimum of two sub-divisions.

MRE 1807 SIMULATORS & CONTROL LABORATORY (51 hrs)

Simulator Lab Experiments

Description of basic engine functions and their simulation introduced in Auto-Chief-II system of Nor-Control.
Manual method of engine operation from engine room station.
Engine Operation from Remote stations i.e. control room and Navigation bridge. Safety and interlocks in UMS-ships- Effect of malfunction of main engine and auxiliaries.
Electronic logic circuits in remote control stations.
Simulation of engine functions in logic circuits.
Study and adjustments of logic circuits for remote control operation of main engine and trouble shooting.
Interfacing - Input/Output interfacing and pneumatic Interfacing in the system.
Role of classification societies with reference to UMS-Ships.

Control Lab. Experiments.

Operation of automatic Viscosity Controller and maintaining a specific viscosity of a given fuel.
Operation of an Automatic flow controller and measuring the flow from in a given pipe.
Operation and utility of a 3 Term (P + I + D) Pneumatic controller.
To study the functioning of a Mist Detector and checking the alarm when the Pre-set value is exceeded.
Study the operation of fire detection unit using lonization chamber type detector.
CNC&VMC machines, microprocessor controlled DC & Ac machines, SCADA.

MRE 1808 SEMINAR (34 hrs)

Students shall individually prepare and submit a seminar report on a topic of current relevance related to the field of Marine Engineering. The reference shall include standard journals, conference proceedings, reputed magazines and textbooks, technical reports and URLs. The references shall be incorporated in the report following International standards reflecting the state-of-the-art in the topic selected. Each student shall present a seminar for about 30 minutes duration on the selected topic. The report and presentation shall be evaluated by a team of internal experts comprising of 3 teachers based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

MRE 1809 PROJECT WORK (85 hrs)

Each batch comprising of 4 to 6 students shall identify a project related to the curriculum of study. Each batch shall submit a project synopsis comprising of the following to the project coordinator.

- Application and feasibility of the project
- Complete and detailed design specifications.
- Block level design documentation
- Detailed design documentation including block/line diagrams and algorithms
- Project implementation action plan using standard presentation tools

The Director/Course-in-charge together with the project coordinator will examine the project design and accept the work if all the above mentioned details are covered in the same and the topic selected is relevant to the marine engineering field. The Director allocates project guide to each team. The final evaluation of the project work is done by a team consisting of minimum three internal teachers including the project coordinator, and the Director based on the criteria fixed by the Department and the University.

MRE 1810 VIVA-VOCE

At the end of the course, a Viva-Voce is conducted as per the guide lines given by the University.