# CURRICULUM FOR

# DIPLOMA IN

# SHIPBUILDING ENGINEERING

## SEM I, II, III, IV, V, VI,

## VII & VIII

**PROGRAMME STRUCTURE**

## SET II

**Semester - I**

| Course code | Name of Course | TEACHING SCHEME | | | | EXAMINATION SCHEME | | | | Total marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | Theory Marks | | Practical Marks | | |
| | | | | | | TH | TM | PR/OR | TW | |
| **GN101** | Communication Skills | - | - | 2 | 2 | - | - | 50 | 50 | 100 |
| **GN102** | Engg. Maths-I | 4 | 2 | - | 6 | 75 | 25 | - | - | 100 |
| **GN103** | Applied Physics-I | 4 | - | 2 | 6 | 75 | 25 | - | 50 | 150 |
| **GN104** | Applied Chemistry | 3 | - | 2 | 5 | 75 | 25 | - | 50 | 150 |
| **GN204** | Engg. Drawing | 2 | - | 4 | 6 | - | - | 50 | 50 | 100 |
| **Total** | | **13** | **2** | **10** | **25** | **225** | **75** | **100** | **200** | **600** |

**Semester - II**

| Course code | Name of Course | TEACHING SCHEME | | | | EXAMINATION SCHEME | | | | Total marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | Theory Marks | | Practical Marks | | |
| | | | | | | TH | TM | PR/OR | TW | |
| **GN201** | Engg. Maths-II | 4 | 2 | | 6 | 75 | 25 | - | - | 100 |
| **GN202** | Applied Physics-II | 4 | - | 2 | 6 | 75 | 25 | - | 50 | 150 |
| **GN203** | Environmental Studies | 3 | - | - | 3 | 75 | 25 | - | - | 100 |
| **GN205** | Engg. Materials | 4 | - | - | 4 | 75 | 25 | - | - | 100 |
| **GN105** | Computer Fund. & App. | - | - | 4 | 4 | - | - | 50 | 50 | 100 |
| **GN106** | Basic Engg. Skills | - | - | 6 | 6 | - | - | 50 | 100 | 150 |
| **Total** | | **15** | **2** | **12** | **29** | **300** | **100** | **100** | **200** | **700** |

## GN 101 COMMUNICATION SKILLS

### 1. RATIONALE

This course deals with Student's proficiency in English by developing their skills in reading, writing and speaking. They will be able to appreciate the usage of grammar. Acquiring proficiency in English is absolutely essential for effective communication while serving on the job. It also deals with applications of the concepts and principles learnt. Using visuals in written communication and body language in oral communication highly enhances the effectiveness of the communication process. These and some other important aspects are discussed in this course. The practice-feedback-practice cycle is of utmost important for developing the communication competencies/skills.

### 2. TEACHING AND EXAMINATION SCHEME

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **GN-101** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| Communication Skills | | - | 2 | 2 | - | - | 50 | 50 | **100** |

*Minimum passing % : Practical 40%*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. DETAILED COURSE CONTENTS

**Unit 1 - Fundamental of Communication skills**

Definition, components (message, sender, receiver, transmission medium and protocol), types(verbal & no-verbal, technological & non-technological, etc), importance of communication skills, effective communication skills (phatic stage, personal stage and intimate stage), barriers in effective communications(verbal, non-verbal), barriers while speaking, other barriers (individual's viewpoints, emotional block, etc.) methods of and hint to increase communication skills, body language.

**Unit 2 – Presentation Skills**

Methods and styles of presentations (seminars, speeches, etc), the plan, objectives, audience, structure (sequential, hierarchical, question oriented pyramid, meaty sandwich), tips for good beginning and end, aids to presentation (visual, verbal), delivery style (eyes, voice, expression, appearances, stance, etc), techniques for a good speech (repeat, draw (signs, pictures), jokes, etc).

**Unit 3 - Technical Reports, Letter Writing, CVs**

Functions of Reports (information, initiate action, recommend new procedures, recording, coordinating project), techniques (basic format, steps, appendices), types of reports (emphasis on progress reports, industrial visit reports, inspection reports, accident reports, survey report, report on seminars, workshop, technical gathering, etc).

Types of letters, format function, qualities of a good letter, examples of job applications, leave applications, complaints, purchase orders, enquiries replies etc.

Brief mention of importance of etiquette in email communication, importance of careful proofing the documents sent.

Curriculum Vitae – definition, sample, tips for a good CV, covering letter

**Unit 4 - Soft Skills**

Importance of values, attitude and etiquettes in communication, ethics and manners, courtesy, honesty and reliability; personal integrity, flexibility – adaptability, team skills – cooperation; ability to follow regulations; willingness to be accountable; Ability to relate to co workers in a close environment, non verbal communication, leadership skills – self directed, ability to direct and guide others, self-supervising; ability to relate to co workers in a close environment; positive attitude; positive work ethic, written communication Skills- basic spelling and grammar; reading and comprehension, personal hygiene and energy, interpersonal skills – communication skills with public, fellow employees, supervisors, and customers, motivation – willingness to learn; caring about seeing the company succeed; understanding what the world is all about; commitment to continues training and learning; critical thinking skills, grooming – good personal appearance.

**Unit 5 - Language Workshop**

The Reading, Listening, Writing, Speaking Skills will be tested

1. **Reading Skills:**

   Articles from the newspapers, magazines, journals etc. will be given to the students to read aloud thus checking their pronunciation, clarity and their style of reading.

2. **Listening Skills:**

   Passages, Topics, Stories, Speeches of eminent people will be read or played. The students have to listen and their listening skills will be tested.

3. **Writing Skills:**

   a) Students to write on any given topic

   b) Students to compose their own stories

   c) Students will be given a particulars situation i.e. accident, college gathering etc. and asked to write a report

**4. Speaking Skills:**

a) Students to speak on any given topic

b) Narrate a story written by them.

Group discussions in the classroom. This could include debates, discussion on current issues, role-playing.

**4. List of Experiments :**

- Oral presentation about technical products for five minutes.
- Seminar Presentation/Report writing and presentation on identified topics from science and technical subjects for short duration.
- Group discussion on science and technical topics.
- Organise mock interviews.
- Organise debates.
- Extempore speech for three minutes on a topic.
- Observe a process and reproduce orally in own words for three to five minutes.
- Arrange video recording of presentations for self-feedback.

**5. SUGGESTED LEARNING RESOURCES**

| S.No. | Author | Title of Books | Year of Publication |
|---|---|---|---|
| 1 | Wren and Martin | Practical English Grammar | 1992 |
| 2 | John Sinclair (ed.), | Collins Cobuild English Grammar | William Collins & Sons Cp., London 1990 |
| 3 | Krishna & Mohan, | Effective English Communication | Tata McGraw Hill, New Delhi 2000 |
| 4 | Randolf, Quirk & Sidney Greenbaum | University Grammar of English | 1993 |
| 5 | Tiwari, N.P. et al , | Communication Skills for Technical Students – Book | Somaiya Publications, 1995 |
| 6 | Tiwari, N.P. et al, | A Communicative Grammar of English | Somaiya Publications, 1989 |

## GN 102 ENGINEERING MATHEMATICS- I

### 1. RATIONALE

There are variable and constant concepts in the engineering phenomena and problems, which need to be understood, analyze and predict their behaviour. For instance, motion and acceleration of an object under applied known force, effect of temperature and pressure under constant volume, etc. All these situations require modeling of constants and variables into a relationship known as formula (formulating) and solving problems of engineering by substituting the values of constants and variables. Thus mathematics is used to understand, analyse and find solutions. There are some standard principles and formulae, which should be understood by students and apply as per needs of situations in real life.

### 2. TEACHING AND EXAMINATION SCHEME

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **GN-102** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| Engineering Mathematics | 4 | 2 | - | 6 | 75 | 25 | - | - | **100** |

*Minimum passing % : Theory 40%*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. DETAILED COURSE CONTENTS

**Unit 0 Fundamentals of algebraic mathematical operations**

- Use of scientific calculator
- Recall of algebraic operations & formulae
- Solving of simultaneous equations with two variables

**Unit 1 Co-ordinate Geometry/ Analytic Geometry;**

Purposes/Applications of Co-ordinate Geometry. Coordinate systems. *Straight Line*- Distance between two points. Internal & external division of a line. Area of triangle. Slope of line. Angle between two lines. Various forms of equation of line-parallel to axis, point-slope form, slope intercept form, two point form, intercepts form & normal form. General equation of line. Distance of a point from a line. - Equations of circle, Equations of tangent & normal to circle.

**Unit 2 Trigonometry**

Purposes/Applications of Trigonometry. Radian. Radian & degree. Area of sector & length of an arc. Trigonometric ratios of any angle & Trigonometric identities. Trigonometric ratio of allied angles, compound angles, & Multiple angles( only 2A ). Sum & product formulae. Sine, Cosine rules. Solution of triangles

**Unit 3 Limits & Functions**

Functions- constants, variables. Kinds of functions ( question not to be asked ). Concepts of limits- algebraic, trigonometric, logarithmic & exponential functions (No question on method of substitution and Inverse Trigonometric function)

**Unit 4 Differential Calculus**

Purposes/Applications of Differential Calculus. Definition of Derivative. Derivatives of standard functions-applications. Derivative of sum, difference, product & quotient of a function. Derivative of composite, implicit & parametric functions with reference to - algebraic, logarithmic, trigonometric, inverse circular functions, exponential functions & logarithmic differentiations. Introduction to Second order derivatives.

**Unit 5 Application of derivatives**

Geometrical meaning of derivatives. Equation of tangent & normal to curves. Derivatives as rate, motion, related rates. Maxima & minima.

## 4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Co-ordinate Geometry | **14** | **20** |
| 2 | Trigonometry | **17** | **16** |
| 3 | Limits & Functions | **8** | **12** |
| 4 | Differential Calculus | **15** | **20** |
| 5 | Application of derivatives | **10** | **07** |
| | | **64** | **75** |

## 5. SUGGESTED LEARNING RESOURCES

| S.No. | Author | Title of Books | Publication & Year |
|---|---|---|---|
| 1. | Deshpande S.P., | Mathematics for Polytechnics | Griha Prakashan, Pune, 1996 or latest |
| 2. | Grewal B.S; | Engineering Mathematics | Khanna Pub., New Delhi1995 or latest |
| 3. | Prasad, I.B.; | Engineering Mathematics | Khanna Pub., New Delhi1997 or latest |
| 4. | TTTI, Bhopal | Mathematics for Polytechnics Vol. – I & Vol. – II | TTTI, Bhopal<br>Latest |
| 5. | Wartiker P.N., | Applied Mathematics | Griha Prakashan Pune, 1996 or latest |

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## GN 103 APPLIED PHYSICS-I

### 1. RATIONALE:

Being the basis of all engineering branches, the students must acquire knowledge of basic principles; laws and facts of Physics This knowledge will improve their ability to apply it in solving engineering problems and overall growth of their disciplines.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **GN-103** Applied Physics I | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | **150** |
| | 4 | - | 2 | 6 | 75 | 25 | 50 | - | |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. DETAILED COURSE CONTENTS

**Unit 1 UNITS & DIMENSIONS**

Fundamental and Derived Physical Quantities and their SI units. Dimensions and Dimensional formula, Principle of Homogeneity, use of Dimensional Analysis for checking the correctness of an equation. Definition of least count of Vernier Caliper, Micrometer Screw Gauge.

**Unit 2 KINEMATICS**

Vectors and Scalars-Definition, Difference between vectors and scalars, types of vectors with example.
Definition - Displacements and distance, Velocity and speed, uniform and average velocity, Uniform acceleration and retardation, problems based on kinematic equations for uniform acceleration. $V=u+at$, $S=ut + \frac{1}{2} at^2$, $v^2 = u^2 + 2as$. Velocity- time diagram, Motion under gravity.

**Unit 3 PROPERTIES OF MATTER**

Definition of Elasticity, Stress, Strain and Elastic limit. Hooke's Law. Definition of Young's modulus, Bulk modulus, Rigidity modulus. Determination of Young's modulus by Searle's method. Behaviour of wire under continuously increasing stress. Definition of Yield Point, Breaking Stress, and Factor Of Safety. Adhesive and Cohesive forces. Angle of contact. Concept and definition of Surface Tension, Surface Tension by Capillary rise method. Application of Surface Tension. Definition and explanation of Viscosity. Statement of Newton's law of viscosity, Terminal Velocity (no derivation) Stokes Law. Determination of Viscosity by Stokes method. Streamlined and Turbulent flow. Definition of Critical Velocity, Reynolds Number.

**Unit 4 HEAT**

Definition of specific heat and units of specific heat. Modes of transfer of heat transfer, Conduction, Convection and Radiation. Law of thermal conductivity. Definition of co-efficient of thermal conductivity. Determination of coefficient of thermal conductivity of a good conductor

Statement of Charles's law, Boyle's law and Gay Lussac's law. Derivation of general gas equation.

**Unit 5 ELECTROSTATICS**

Coulomb's Law of Electrostatics, Electric Field, Intensity of Electric Field, Electric Potential and its unit, Potential difference between two points (no derivation), Potential of a sphere, Potential of Earth, Definition and units of Capacitance, Principle of Capacitor, Capacitors in series, Capacitors in Parallel.

**Unit 6 MAGNETISM**

Magnetic Effect of Electric current (Oersted's Experiment) Magnetic Field, Intensity of Magnetic Field. Coulomb's Law of Magnetism, Magnetic lines of Force, Magnetic Induction, Expression for Magnetic Induction at the centre of a Circular coil carrying current ( no derivation), Force acting on straight conductor placed in Magnetic Field ( no derivation).

**Unit 7 (A) LAWS OF FORCES & FRICTION ( MECHANICAL AND ALLIED GROUPS)**

Triangle law of forces, parallelogram law of forces (expression only), graphical & analytical representation of force, resolution of forces, resolving force into rectangular components.

Definition & concept of friction, types of friction, Force of friction, Laws of static friction, Coefficient of friction, angle of friction (expression only), angle of repose( only qualitative aspects)

**OR**

**UNIT 7(B) : SEMICONDUCTORS (ELECTRONICS AND ALLIED GROUPS)**

Energy Band structure of electronic material( conductor , semiconductor and insulator)

Definition of semiconductors, types of impurities added to the semiconductors, intrinsic and extrinsic semiconductors.

Types of semiconductors P- type and N- type, Structure of P- type and N- type,

Extrinsic semiconductor using pure Si and Ge semiconductors.

Types of carriers; N- type and P- type

Process of recombination of carriers.

Formation of P-N junction and depletion region.

## 4.SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

| Unit No. | Unit | Teaching Hours / Semester | Marks |
|---|---|---|---|
| 1 | Units and Dimensions | 5 | 5 |
| 2 | Kinematics | 9 | 12 |
| 3 | Properties of Matter | 13 | 14 |
| 4 | Heat & Gas Laws | 9 | 10 |
| 5 | Electrostatics | 12 | 12 |
| 6 | Magnetism | 8 | 10 |
| 7A | Laws of Forces & Friction | 8 | 12 |
| | **OR** | | |
| 7B | Semiconductors | 8 | 12 |
| | Total | **64** | **75** |

**7A-Mechanical and allied branches** **7BFor Electronics and allied branches**

## 5. SUGGESTED LIST OF EXPERIMENTS

| Sr. No. | LIST OF EXPERIMENTS |
|---|---|
| 1 | Use of Vernier Caliper |
| 2 | Use of Micrometer Screw gauge |
| 3 | Determination of Surface tension by capillary rise method using Travelling Microscope. |
| 4 | Determination of coefficient of viscosity by stroke's method. |
| 5 | Determination of acceleration due to gravity ('g') by simple pendulum. |
| 6 | Determination of Young's modulus by Searle's method. |
| 7 | Determination of Coefficient of thermal conductivity by Searle's method. |
| 8A | Find resultant force using parallelogram of forces |
| 8B | Draw and interpret band structure of Insulator, Semiconductor and conductor, Band structure of P-type & N-type extrinsic semiconductor, Drawing PN junction. |

## 6. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title | Publication and Year |
|---|---|---|---|
| 1. | Halliday D and Resnickr | Physics Part-I & II | Latest |
| 2. | Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M., | Physics Part-I & II for 10+2 Students | Latest |
| 3. | B.G. Dhande | Applied physics for polytechnics | Latest |
| 4. | Bhandarkar | Applied Physics for polytechnics | Latest |
| 5. | Saxena HC & Singh Prabhakaer | Applied Physics Vol. I & II | Latest |
| 6. | Rao, B.V.N. | Modern Physics | Latest |
| 7. | R.K.Guar and S.L. Gupta. | Engineering Physics | Latest |
| 8. | B.L. Thereja. | Engineering Technology | Latest |
| 9. | Modern Publishers. | ABC of Physics | Latest |
| 10. | V.K Mehta | Elements of electronic engineering | Latest |
| 11 | R S Khurmi | Applied Mechanics | Latest |

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## GN 104 APPLIED CHEMISTRY

### 1. RATIONALE

Applied Chemistry is multi-disciplinary science having wide applications in all the branches of engineering and technology. In simple terms, it is the science of chemical phenomena in various engineering situations. An understanding of the basic concepts of applied chemistry is essential not only for all chemists but also for engineers. Therefore it forms an indispensable base for them. The emphasis is given more on applications of principles of chemistry to engineering situations rather than fundamental principles only. It also develops in the students the habit of scientific enquiry, ability to investigate the cause and effect relationship, ability to interpret and analyze the results under given conditions.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **GN-104** Applied Chemistry | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | **150** |
| | 3 | - | 2 | 5 | 75 | 25 | 50 | - | |
| | | | | | | | | | |

*Minimum passing % : Theory 40%*

***Legends:***
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. DETAILED COURSE CONTENTS

**Unit 1 Atomic Structure and Chemical Bonding**

Fundamental particles and their characteristics, Energy levels - definition, designation of energy levels, Bohr- Bury's laws for distribution of electrons in shells ($1^{st}$ three laws only), concept and shape of orbitals (s and p only), Quantum numbers-designation, definition, values, Aufbau and Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, orbital electronic configuration of elements with atomic number 1 to 20, Lewis and Langmuir concept of stable configuration. Concept of electrovalent, covalent and co-ordinate bond, Formation, properties and examples of electrovalent compounds (NaCl, MgO, $CaCl_2$) covalent compounds ( $Cl_2$, $0_2$, $N_2$, $C0_2$)and coordinate compounds ($0_3$, $S0_2$).

**Unit 2 Electrochemistry**

Arrhenius theory of electrolytic dissociation., Degree of Ionisation- definition, factors affecting degree of ionisation , Nature of solute and solvent, concentration of solution, and temperature, Strong and weak electrolytes - definition and examples, Concept of the terms involved in electrolysis –conductor, insulator, electrolyte, non-electrolyte, electrolysis, electrodes, electrolytic cell, cathode, anode and current density, electrochemical series- concept and significance. Mechanism of electrolysis, Ionisation, primary reactions at the cathode, activity series of cations, primary reactions at the anode, activity series of anions, electrolysis of i. Fused NaCl using carbon electrodes, ii. aqueous NaCl using platinum electrodes iii. aqueous $CuS0_4$ using platinum electrodes iv. aqueous $CuS0_4$, using copper electrodes);

**UNIT 3 Water and its treatment**

Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) for industrial use - dyeing, textile, sugar, paper, bakeries, (ii) in boilers for steam generation with special reference to sludge and scale formation ( no chemical equations), zeolite and ion exchange process for water softening, desalination by electro dialysis and reverse osmosis, concept of pH

**Unit 4 Corrosion and Its Control**

Definition, Atmospheric corrosion (direct chemical corrosion) - definition, Oxidation corrosion, the nature of the oxide film, stable, unstable and volatile, mechanism of oxidation corrosion, corrosion due to other gases. Immersed corrosion (electrochemical corrosion) - definition, factors necessary for electrochemical corrosion , Galvanic cell corrosion, concentration cell corrosion- metal ion concentration and differential aeration. Mechanism of electrochemical corrosion- Hydrogen evolution mechanism, Oxygen absorption mechanism, Protection of metals from corrosion; galvanising, tinning, metal spraying , proper designing , using pure metals, using metal alloys, Cathodic protection- sacrificial anode and impressed current .Modifying the environment- De-aeration, De-activation, De-Humidification and alkaline neutralization.

**Unit 5 Lubricants**

Definition, functions of Lubricants, Types of Lubrication, Fluid Film, Boundary, Extreme Pressure, Classification of Lubricant - solid, semi- solid, liquid synthetic oils. Characteristics of Lubricants, Definition and Its significance -Viscosity. Viscosity Index, Flash and Fire Point, Oiliness, Pour Point, Volatility, Acidity, Emulsification and Saponification Value. Selection of Lubricants for Delicate Instruments, High Pressure and Low Speed Machines, Extreme Pressure and Low Speed Machines, Mechanisms of Lubrications.

## 4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

| Unit No. | Name of the unit | Hours | Marks |
|---|---|---|---|
| 1 | Atomic Structure and Chemical bonding | 10 | 15 |
| 2 | Electrochemistry | 08 | 13 |
| 3 | Water and its treatment | 09 | 15 |
| 4 | Corrosion and its control | 16 | 25 |
| 5 | Lubricants | 05 | 07 |
| | Total | **48** | 75 |

## 5. SUGGESTED LIST OF EXPERIMENTS

| Sr. No. | Unit No. | List of Experiments |
|---|---|---|
| 1. | | Double titration of acid and base using phenolphthalein |
| 2. | | Double titration of acid and base using methyl orange |
| 3. | | Redox titration of potassium permaganate, ferrous sulphate and oxalic acid. |
| 4. | | Determination of degree of hardness of water by EDTA method |
| 5. | | Determination chloride content of water by Mohr's method |
| 6. | | Determination of total alkalinity of water sample |
| 7. | | Titration of strong acid and strong base using pH meter |
| 8. | | Determination of conductivity of water |
| 9. | | Titration of strong acid and strong base using conductometer |
| 10. | | Corrosion susceptibility of aluminium to acid or base. |

## 6. SUGGESTED LIST OF ACTIVITIES

| S.No. | Title |
|---|---|
| 1. | Quiz on Electronic configuration of atoms. |
| 2. | Demonstration of process of electrolysis |
| 3. | Demonstration of purification of water by domestic/economical method. |
| 4. | Identification and application of lubricants in different equipment/glasswares used in different laboratories |
| 5. | Visit to some metallurgical industries for demonstration of different processes of metallurgy. |
| 6. | Preparation of chart of different alloys of steel and their uses |
| 7. | Seminar on different aspects of fuel, properties and usages |
| 8. | Use of pH paper for testing different samples of water, blood etc. |
| 9. | Demonstration and use of different samples of paints, varnishes, drying oils, pigments, thinners, dryers, fillers, plasticizers and anti-skinning agents. |

## 7. SUGGESTED LEARNING RESOURCES

| Sl. No. | Author | Title | Publication and Year |
|---|---|---|---|
| 1. | M.M. Uppal | A text book of Engineering Chemistry, | Khanna Publishers |
| 2 | V.P. Mehta | A textbook of Engineering Chemistry, | Jain Bros. Delhi |
| 3 | S.N. Narkhede | A Textbook of Engineering Chemistry | Nirali Prakashan |
| 4 | R.A. Banawat, S.K. Mahajan, S.K.Mehta | Textbook of Applied Chemistry | India Book House |
| | V.S. Godbole | Applied Chemistry | |
| 5 | R.S. Sharma | Textbook of Engineering Chemistry | Khanna Pubnlishers |
| | P.C. Jain and M. Jain | Engineering Chemistry | |
| 6 | J.C. Kuriacose and J. Rajaram | Chemistry in Engineering | Tata McGraw Hill Publishing Co.Ltd., New Delhi |
| 7 | Dr.S. Rabindra and Prof.B.K. Mishra | Engineering Chemistry: | Kumar and Kumar Publishers (P) Ltd., Bangalore -40 |
| 8 | S.S.Kumar | A Text book of Applied Chemistry-I | Tata McGraw Hill, Delhi |
| 9 | Sharma | A Text book of Applied Chemistry -I | Technical Bureau of India, Jalandhar |
| 10 | S.S.Dhara | A Textbook of Engineering chemistry | S.Chand & Company, New Delhi |
| 11 | Dr. G.H. Hugar | Progressive Applied Chemistry – I & II | Eagle Prakashan, Jalandhar |

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## GN 204 ENGINEERING DRAWING

### 1. RATIONALE:

Drawing is a graphical language of engineering field. Engineering technician irrespective of his field of operation in an industry is expected to possess a thorough understanding of drawing, which includes clear spatial visualization of objects and the proficiency in reading and interpreting a wide variety of engineering drawings. It is the skill, which translates an engineering idea into lines and dimensions on a piece of paper. Besides this he is also expected to possess a certain degree of drafting skill- depending upon his job functions-in his day-to-day activities. This course of Engineering Drawing for Diploma courses is aimed at developing basic knowledge and skills of engineering drawing and use of computer in the field of Engineering Drawing.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **GN-204** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| Engineering Drawing | 2 | - | 4 | 6 | - | - | 50 | 50 | **100** |

*Minimum passing % : Theory 40% and Practical 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. DETAILED COURSE CONTENT

**Unit 1 Introduction**

- Importance of Engineering drawing as a means of communication.
- Introduction to drawing equipment, instruments and their uses.
- Planning of drawing sheet as per I.S. 696 - 1972.
- Indian standard practices of laying out and folding of drawing
- Different types of lines used in engineering drawing.
- Importance of scale in Engineering Drawings.
- Lettering

**Unit 2 Dimensioning techniques and standard conventions**

- Methods of dimensioning, Dimensioning terms and notation (use of I.S. code 696 and 2709), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, counter sunk hole, screw thread, taper etc.
- Conventional representation of various materials.

**Unit 3 Engineering Curves & Shapes**

- Construction of an Equilateral and Isosceles triangle,Square,Rhombus,Regular pentagon & Regular hexagon given distance across the corners/ flats and given length of a side using general method of construction
- Types of Engineering curves
- Construction of Engineering curves like
  - Ellipse- by focus & directrix method and arcs of circles method
  - Parabola- by focus & directrix method and rectangle or oblong method
  - Hyperbola- by transverse axis & Focus and directrix method
  - Cycloid- by generating circle rolling on a straight line
  - Involutes of a triangle ,circle & pentagon
  - Draw normal & tangents to the above curves from given point on the curve
- Practice problems of drawing various engineering curves

**Unit 4 Orthographic projection**

- Definitions of various terms associated with orthographic projections.
- Planes of projections.
- Concept of Quadrants.
- First and third angle method of projection.
- Projection of points
- Projection of lines
  - (i) Parallel to both Principal planes
  - (ii) Parallel to one and Perpendicular to other Principal plane.
  - (iii) Inclined to one plane and parallel to other plane.
- Projection of Triangle, Square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.
- Introduction to the following solids
  Cylinder, cone, cube.

  Right regular solids such as

  (i) Prism: Triangular & Square
  (ii) Pyramid: Square & Pentagonal.
  - Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane.

- Conversion of simple pictorial views into orthographic views.
- Practice problems on projection of points, lines and planes.
- *Problems where one end of the line is in one quadrant & other end in other quadrant and traces are to be excluded.*
- *Problems where apparent projection of plane are given, true shape & slope angle are to be drawn are excluded.*

**Unit 5 Section of solids**

- Concept of sectioning planes
- Auxiliary planes and true shape of section.
- Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)

**Unit 6 Development of lateral surfaces**

- Concept and importance of surface development in the engineering field.

  Methods of development of surfaces-Radial & Parallel line method.

  Development of surfaces for the following right regular solids-
- Cylinder
- Prism
- Cone
- Pyramids
- Development of solids standing on its base & cut by a plane inclined to either VP/HP and perpendicular to the other is also included.
- *Practice problems on above with top & bottom of the solid is excluded*

**Unit 7 Isometric Views**

- Limitations of orthographic projections.
- Procedure for preparing isometric projections.
- Difference between Isometric projection & Isometric view.
- Isometric view of geometrical solids and simple machine parts.
- Conversion of orthographic views into isometric views.
- Construction of Isometric view for any real object. Conversion of orthographic views of simple components into isometric views.

## 4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

| Unit No. | Unit | Teaching Hours / Semester |
|---|---|---|
| 1 | Introduction | **1** |
| 2 | Dimensioning techniques & standard conventions | 1 |
| 3 | Engineering Curves & Shapes | 4 |
| 3 | Orthographic projections | **13** |
| 4 | Section of solids | 3 |
| 5 | Development of surfaces | 4 |
| 6 | Isometric projections | 2 |
| - | Revision | 4 |
| | **Total** | **32** |

## 5. SUGGESTED LIST OF ACTIVITIES

Following shall be the list of sheets to be prepared as Engineering drawing lab work

| Sheet No. | TITLE | Contents | Hours |
|---|---|---|---|
| 1. | TYPES OF LINES, LETTERING, DIMENSIONING. | All types of lines, Single stroke vertical capital letters, Methods of Dimensioning-Aligned & unidirectional System, Conventional representation of materials. | 4 |
| 2. | GEOMETRICAL CONSTRUCTIONS | Construction of Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & hexagon | 4 |
| 3. | ENGINEERING CURVES | Construction of ellipse, parabola, hyperbola by given methods. Involutes, cycloid. Draw normal and Tangent to curves. | 8 |
| 4. | PROJECTION OF POINTS & LINES | Drawing projection of points in all 4 quadrants.<br>Drawing of projections of lines in following positions<br>(i) Parallel to both Principal planes<br>(ii)Parallel to one and Perpendicular to other Principal plane.<br>(iii) Inclined to one plane and parallel to other plane. | 6 |
| 5 | PROJECTION OF PLANES | Drawing the projection of Triangle square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane. | 6 |
| 6 | PROJECTIONS OF SOLIDS | Drawing projection of following solids Cylinder, cone, cube.<br>Right regular solids such as Prism: Triangular & Square,Pyramid: Square & Pentagonal,when axis is inclined to one principal plane & parallel to other principal plane. | 8 |
| 7 | ORTHOGRAPHIC PROJECTIONS | Simple problems on conversion of pictorial into orthographic views.(atleast 2 problems each in 1st angle and 3rd angle) | 4 |
| 8 | SECTIONS OF SOLIDS | Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other) | 8 |

| | | | |
|---|---|---|---|
| 9. | DEVELOPMENT OF LATERAL SURFACES | Draw the Development of surfaces for the following right regular solids-<br>Cylinder, Cone, Prism & pyramids (square, triangular, pentagonal). | 8 |
| 10 | ISOMETRIC VIEWS | Conversion of orthographic views of simple components into isometric views. | 8 |

## 6. SUGGESTED LEARNING RESOURCES

| S.No. | Author | Title | Publisher |
|---|---|---|---|
| 1. | BIS, India | IS. 696. (Latest revision). | BIS, India |
| 2. | N.D. Bhatt | Engineering Drawing | Charoter Publisher,Anand |
| 3. | R. K. Dhawan | Engineering Drawing & Machine Drawing | Kumar |
| 4. | R.B. Gupta | Engineering Drawing | Satya Prakashan, Delhi |
| 5. | P.S. Gill | Geometrical Drawing | Ketson & Sons |
| 6. | P.S. Gill | Machine Drawing | Ketson & Sons |
| 8. | TTTI, Bhopal | Work Book in Mechanical Drafting | TTTI, Bhopal |
| 9. | T. Jeyapoovan | Engineering Drawing & Graphics Using AutoCAD 2000 | Vikas Publishing House Pvt. Ltd, New Delhi. |
| 10 | N.D. Bhatt | Machine Drawing | Charoter Publisher,Anand |

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# SEMESTER II

## GN-105 - COMPUTER FUNDAMENTALS & APPLICATIONS

### 1. RATIONALE

The course on Computer Fundamentals & Applications will enable the students to understand the basic concepts related to computer fundamentals, Data Representation & Number Systems, Computer Languages, operating system, Computer Software and Internet Technology and will be able to apply the same in different areas of electronics engineering. Laboratory practice will help in developing the requisite skills.

### 2. TEACHING AND EXAMINATION SCHEME

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **GN-105** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| Computer Fundamentals & Applications | - | - | 4 | 4 | - | - | 50 | 50 | **100** |

*Minimum passing % : Theory 40%*

***Legends:***
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. DETAILED COURSE CONTENTS

**UNIT 1 Computer Fundamentals**

1.Introduction to Computer

2. History, Evaluation, Classification and Generations of computers

3.Organisation of the Computer System

4. Hardware

Input device, Memory or Storage Devices, Processing Unit, Output device, Scanner

Printers.

5. Communication technology and evolution of communication mediums

6. Software

System software

Application Software

Shareware

Freeware

Open Source

7. Concept of Computer Viruses

Definition

Types

Preventive Measures

**UNIT 2 Operating System**

1. Introduction to operating system

Definition Functions , Types, Examples, Comparisons of Various Operating Systems

2. Windows Operating System-

GUI(Graphical user Interface), desktop, Start Menu, Task Bar, Status Bar, Scroll Bar, Title Bar, Toolbar, Menu Bar. File Organization: Creating, Saving, Deleting, Renaming, Cutting, Pasting, copying, moving, Searching Files and Folders. Applications: My Computer, Recycle Bin, Windows Explorer, Control Panel.

**UNIT 3 Application Software**

**1. MS Word**

- Introduction
  - Starting MS Word
  - Creating, saving and opening a document
  - Editing commands-Cut, Copy, Paste, Paste Special
  - Text Formatting, Bullets and Numbering, Borders and shading etc.
  - Tabs, Style, Views
  - Insert Table, Picture, OLE Objects, etc.
  - Checking Spelling and Grammar, Thesaurus
  - Page Layout & Printing
  - Mail Merge**.**

**2. MS Excel**

- Create, Save and open a worksheet
- Entering data – text, numbers and formulae in a worksheet, Hyperlink
- Navigating within a Worksheet and also between different Worksheets of a Workbook
- Inserting and deleting cells, rows and columns in a worksheet
- Select, copy, paste and delete cell data within the worksheet

- Using various formulae and inbuilt functions like Trigonometric, Statistical, Logical, Data Sorting
- Update worksheets using special tools like spell check and auto correct.
- Setup the page and margins of worksheets for printing
- Enhance worksheets using charts & graphs

**3. MS Power Point**

- Introduction and starting the program
- Starting a presentation
- Adding new slide
- Saving and Opening presentation
- Text formatting options
- Copy, Move and delete slides and text
- Applying designs
- Using Animations
- Slide Transitions, Hyperlink
- Insert clip art
- Viewing the presentation

**UNIT 4 The Internet**

**Networks, Advantages of networking, Types of networks.**

- History and Functions of the Internet
- Working with Internet
- Web Browsers, World Wide Web, Uniform Resources Locator and Domain, Names, Issues related to web security.
- Uses of Internet
- Search for information, Email, Chatting, Instant messenger services, News Group, Teleconferencing, Video-Conferencing, E-Commerce and M-Commerce.

**Email**

- Manage an E-mail Account
  E-mail Address, Configure E-mail Account, log to an E-mail, Receive E-mail, Sending mails, sending files an attachments and Address Book
- Downloading Files

## 4. SUGGESTED LIST OF EXPERIMENTS

| S. No. | Unit No. | List of Experiments |
|---|---|---|
| 1 | **1** | Identify Input and output devices |
| 2 | **1** | Calculate capacity of different storage device |
| 3 | **2** | Identify OS and different application software s loaded on that OS |

| | | |
|---|---|---|
| 4 | **3** | Load Windows operating system. Configure and load relevant device drivers |
| 5 | **4** | Practice on Windows 95/98/2000 ;<br>o Starting Windows, Exploring the desktop, Arranging windows, My Computer, The start button, Creating Shortcuts, Practice on moving and sizing of windows<br>o Study of file organization: creating, copying, moving, renaming and deleting<br>o Practice on Windows Accessories- Notepad, Word Pad and Paint<br>o Editing document & formatting text, Previewing and printing document/Image file<br>o Practice on Windows Explorer<br>**o** Recycle bin<br>**o** Shutting down windows |
| 6 | **4** | Practice on MS-Word ;<br>o Create and format document<br>o Edit and Modify text- changing font size type and style<br>o AutoText, AutoComplete, AutoCorrect, grammar and spellchecker, Find and replace of text<br>o Open save and print a document<br>o Insert, modify table<br>o Insert graphics<br>o Mail merge |
| 7 | **5** | Practice on Microsoft Excel<br>o Create, save & format worksheet<br>o Open and save worksheet file<br>o Edit & modify data<br>o Use formula and functions<br>o Split windows and freeze pans<br>o Data sort and security features<br>o Create, edit, modify and print worksheet.<br>o Create and edit charts |
| 8 | **5** | Practice on PowerPoint<br>o Create, edit, insert, move, slides<br>o Open and save presentation<br>o Insert picture, audio slide layout, action button<br>o Apply custom animation<br>o Present slide show |
| 9 | **6** | Practice on:<br>o Identification of type of Account.<br>o Connecting to internet<br>o Dial up access<br>o Web browsing<br>o Searching websites<br>o Information searching<br>o Email services<br>**o** Creating email accounts & Receiving and sending mails |

## 5. SUGGESTED LEARNING RESOURCES

| S.No. | Author | Title of Books | Publication & Year |
|---|---|---|---|
| 1 | Norton Peter | Introduction to Computers (special Indian edition) | Tata McGraw Hills New Delhi, 6th Edition, 2005<br>ISBN: 0070593744 |
| 2 | Kahate Atul | Information Technology | Tata McGraw Hills New Delhi,<br>ISBN-13:9780070593718 |
| 3 | Williams Stalling | Using Information technology: A Practical Introduction to Computers and Communication | Tata McGraw Hills New Delhi, |
| 4 | Curtin | Information Technology: The Breaking Wave (book only) | Tata McGraw Hills New Delhi,<br>ISBN:0074635581 |
| 5 | Ravichandran, D | Introduction to Computers and Communication | Tata McGraw Hills New Delhi,<br>ISBN: 0070435650 |
| 7 | Douglas E. | The Internet Book | Prentice Hall of India, New Delhi, 3rd Edition,<br>ISBN: 812032286X |
| 8 | Basanbhara S.K. | Computer Today | Nita Mehta Publications, 2003<br>ISBN: 8186340742 |

# GN 106 BASIC ENGINEERING SKILLS

1. **Rationale**:

A technician is expected to work on the shop floor. It therefore becomes essential for him to have a through exposure to safety aspects, fire fighting, first aid as he is the guide for the skilled and unskilled personnel working under him. From technical knowledge and skills point of view he is also expected to have knowledge on proper ways of using various hand tools, measuring devices etc. in addition to other engineering skills.

The course on Basic Engineering skills is aimed at providing him the knowledge and skills in all those areas through shop instructions, demonstrations and skill development exercises. This course is also aimed at providing the student the exposure to engineering equipment which will help him to assimilate the teaching which takes place at higher semesters.

2. **Teaching And Examination Scheme**

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| (GN106) Basic Engineering Skills | L | T | P | C | TH | TM | PR/OR | TW | 150 |
| | 0 | 0 | 6 | 6 | - | - | 50 | 100 | |

Legends: L-Lectures; P-Practical; C-Credits; TH-End Semester Theory; TM-Test Marks;

PR/OR-End Semester Practica/Oral Examinations TW- Term Work

3. **Detailed Course Contents**

| |
|---|
| **Unit 1: General Safety, Housekeeping, Fire Fighting & First Aid**<br>Introduction to General Safety aspects of engineering workshop, meaning and importance of housekeeping, possible fire hazards, fire triangle, types of fire extinguishers – selection and use, basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies. |
| **Unit 2: Fitting Workshop Practice**<br>Introduction to the trade, Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools, Types of files and filing methods. Drill bits and drilling Processes, using portable and pillar drilling machine. Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling tapping and deing. Use of spirit level and plumb bob. |
| **Unit 3: Carpentry Workshop Practice**<br>Introduction to the trade, types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools, wood working processes. Different types of joints and their usage. Introduction to wood working machines- lathe , circular saw, band saw, wood planner, universal wood working machine. |
| **Unit 4: Electrical Workshop Practice** |

| |
|---|
| Brief introduction to power distribution, different hand tools used in electrical trade, different measuring instruments. Making of cable joints. Measurement of current, voltage, frequency and Power Consumption. Connecting and starting of Induction Motor. Changing of Direction of rotation of induction motor. Introduction to commonly used electrical Fittings (Domestic & Industrial). Reading of simple electrical drawings. |
| **Unit 5: Basic Electronics Workshop Practice**<br>Introduction to basic electronic components, Introduction to use of Multimeter in measuring voltage, current, resistance, capacitance. Checking of connectivity. Introduction to soldering process. Soldering Irons- Types and wattage. Reading of basic electronic circuits. |

**Note: during first 20 minutes of the practical session, Instructor shall provide theoretical knowledge as prescribed in the curriculum. (Shop Talk)**

| Unit No. | Topic | Hours/ Semester |
|---|---|---|
| 1. | General Safety, Housekeeping, Fire Fighting & First Aid | 06 |
| 2. | Fitting Workshop Practice | 36 |
| 3. | Carpentry Workshop Practice | 18 |
| 4. | Electrical Workshop Practice | 18 |
| 5. | Basic Electronics Workshop Practice | 18 |
| | *Total* | **96** |

## GN201 ENGINEERING MATHEMATICS- II

### 1. RATIONALE :

Mathematics is the backbone of all areas of engineering and technology and hence technician / engineers need to study relevant theories and principles of mathematics to enable them to understand and grasp the concept of advance courses of the curriculum. With above in mind, the necessary content for the engineering mathematics is derived to understand advance use of mathematics in solving engineering problems.

### 2. TEACHING AND EXAMINATION SCHEME :

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **GN-201** Engineering Mathematics-II | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | **100** |
| | 4 | 2 | - | 6 | 75 | 25 | - | - | |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. DETAILED COURSE CONTENT :

| |
|---|
| **Unit 1 Determinants**<br>Determinants of the second order and third order, solutions of equations in two or three variables using Cramer's Rule |
| **Unit 2 Binomial Theorem** - Binomial Theorem for a rational index, general term of binomial expansion, middle term (s). |
| **Unit 3 Mensuration** - Volume and surface area of - Prism, pyramid, frustrum of a sphere, frustrum of pyramid, frustrum of cone, Area and volume by Simpsons Rule |
| **Unit 4 Matrices**<br>Definition and Notations,<br><br>Elements of Matrix, Types of matrices, Special matrices - Square, Diagonal, Row, Column, Scalar Unit, Zero or null, upper and lower triangular matrices, Symmetric, Skew symmetric matrices . Addition, Subtraction and multiplication of matrices, Inverse of matrix using Adjoint method only Application of matrices in solving simultaneous equations in 2 or 3 variable. |
| **Unit 5 Integral Calculus**<br>Definition, fundamental properties. Methods of Integration - Integration by substitution, Integration by parts, Integration by partial fractions.. Definition of Definite Integral Properties of definite integrals, Application of integration**,** area under a plane curve, volume of revolution.(simple sums only) |

| |
|---|
| **Unit 6 Differential Equations**<br><br>Definition, order and degree of a differential equation, solutions of differential equations of first order and first degree-variable separable type only. Second order differential equation of type $d^2y/dx^2 = f(x)$ only, Application of differential equation in engineering problems |
| **Unit 7 Statistics (Mechanical and Allied Engg. Branches)**<br>. Measures of central tendency for grouped and ungrouped data - Mean, Median and Mode . Measures of dispersion for grouped and ungrouped data -range , mean deviation, standard deviation, variance and co-efficient of variation |
| **OR** |
| **Unit 7 Complex Numbers. ( Electronics engg and Allied branches)**<br><br>Definitions, Argand diagrams , polar form of a complex number, Addition, Subtraction, Multiplication & Division of a complex number. Exponential and circular function, De-moivres theorem, roots of a complex number- Cube roots of unity, n th roots of unity, , hyperbolic functions |

## 4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY ):

| Unit No. | Topic | Teaching Hours/ Semester | Marks |
|---|---|---|---|
| 1. | Determinants | **5** | **7** |
| 2. | Binomial Theorem | **7** | **10** |
| 3. | Mensuration | **7** | **10** |
| 4. | Matrices | **11** | **08** |
| 5. | Integral Calculus | **17** | **20** |
| 6. | Differential equations | **08** | **10** |
| 7. | Statistics | **09** | **10 $** |
| | **OR** | | |
| 7 | Complex Numbers | **09** | **10 #** |
| | Total : | **64** | **75** |

**$- for Mechanical and allied branches**

**# - For Electronics and allied branches**

## 5. SUGGESTED LEARNING RESOURCES :

| S.No. | Author | Title of Books | Publication & Year |
|---|---|---|---|
| 1. | Deshpande S.P, | Mathematics for Polytechnics | Griha Prakashan, Pune, 1996 or latest |
| 2. | Grewa, I B.S; | Engineering Mathematics | Khanna Pub., New Delhi1995 or latest |
| 3. | Prasad, I.B.; | Engineering Mathematics | Khanna Pub., New Delhi1997 or latest |
| 4. | Wartiker P.N., | Applied Mathematics | Griha Prakashan Pune, 1996 or latest |

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## GN 202 APPLIED PHYSICS-II

### 1. RATIONALE:

Physics is one of the basic building blocks for engineering sciences. Therefore, the students need to describe and explain the basic principles, laws & facts of physics. These skills will enhance their ability to apply it in solving engineering problems related to their respective branches of engineering

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **GN-202** Applied Physics-II | **L** | **T** | **P** | **C** | TH | **TM** | TW | PR/OR | **150** |
| | 4 | - | 2 | 6 | 75 | 25 | 50 | - | |

*Minimum passing % : Theory 40% and Practical 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. DETAILED COURSE CONTENTS

**Unit 1 FORCE, WORK, POWER, AND ENERGY**

Definition of Force and its units. Types of Forces with example- Direct, Remote action e.g. Gravitational Force, Magnetic Force, Electric Force. Effect of Forces on body-External, Internal.

Work-definition and units, Graphical Representation of workdone, Energy definition and units.

Types of Mechanical Energies- K.E. & P.E. Law of Conservation of Energy, Total Energy, Power-definition and units, Power (Force X Velocity)

**Unit 2 CURRENT ELECTRICITY**

Ohms law, General equation of Ohms law, Factors affecting resistance, specific resistance and units. Effect of temperature on resistance, Law of resistance in series and parallel. Internal resistance and EMF of the cell. Potential drop along a uniform wire. Principle of potentiometer. Comparison of EMF of a given cell by single cell method. Camparision of EMF of a given cell by sum and difference method. Use of meter bridge to determine the unknown resistance.

Definition of Electric power and energy in d.c. circuit. Concept of Kilowatt hour, calculation of energy bills.

**Unit 3 ELECTROMAGNETISM**

Electromagnetic Induction, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self Induction & Mutual Induction.

**Unit 4 LOGIC GATES**

Introduction to Binary Number System, Concept of '0' and '1' in Binary System. Binary equivalent of Decimal numbers from 0 to 10

Logic Gates: 1. 'NOT' Gate , 2. 'OR' Gate 3. 'AND' Gate. NAND , NOR GATE Their Logic Representation & Truth Table

**Unit 5 SOUND**

Definition and examples of Free and Forced Vibrations, Resonance. Determination of velocity of sound using Resonance Tube.

Definition of Beats (No derivation), Beat frequency & application of Beats, Definition of Echo, Reverberation & Reverberation time, Sabine's Formula, Acoustical Planning of an Auditorium. Factors affecting Reverberation Time, Ultrasonic waves, Piezo Electric Effect, Applications of Ultrasonic waves.

**Unit 6 CIRCULAR MOTION AND GRAVITATION**

Defination of Uniform Circular Motion, Angular Displacement, Angular Velocity, Relation between Linear and Angular velocity, Defination and concept of Centripetal and Centrifugal Force.(No derivation), Expression for velocity of a vehicle moving on a curved Horizontal Road, Expression for Angle of Banking & Super Elevation of Road. Newton's Law of Gravitation, Force of Gravity. Acceleration due to Gravity, Expression for Acceleration due to gravity.

**Unit 7(A) FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES (MECHANICAL AND ALLIED GROUPS)**

Definition of efforts, velocity ratio, mechanical advantage & efficiency of machine and their relationship. Laws of machines, examples of simple machine, definition of ideal machine, systems of pulleys (First & Second). Determination of velocity ratio ,Mechanical Advantage & Efficiency.

OR

**Unit 7 (B) RECTIFIERS (ELECTRONICS AND ALLIED GROUPS)**

V-I characteristics of P-N junction. Diode as a rectifier. Half wave rectifiers, working, input and output waveforms, percentage regulation,(( V NL – V FL) / V FL )x 100

Full wave rectifier with centre tap transformer, working, input and output waveforms, percentage regulation

Bridge rectifier, working, input and output waveforms, percentage regulation

## 4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS(THEORY)

| Unit No. | Unit | Teaching Hours / Semester | Marks |
|---|---|---|---|
| 1 | FORCE, WORK,POWER & ENERGY | 10 | 12 |
| 2 | CURRENT ELECTRICITY | 16 | 16 |
| 3 | ELECTROMAGNETISM | 6 | 8 |
| 4 | LOGIC GATES & AWARNESS TO NANO SCIENCE | 4 | 6 |
| 5 | SOUND | 8 | 9 |
| 6 | CIRCULAR MOTION & GRAVITATION | 10 | 12 |
| 7A | FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES | 10 | 12 |
| | OR | | |
| 7B | RECTIFIERS | 10 | 12 |
| | Total | **64** | **75** |

**7A- for Mechanical and allied branches** **7B- For Electronics and allied branches**

## 4. LIST OF EXPERIMENTS

1. Determination of Specific resistance of a material wire by Voltmeter and Ammeter.
2. Determination of Internal resistance of a given cell by using Potentiometer.
3. Calibration of Voltmeter by using Potentiometer.
4. Comparison of E.M.F. of two given cells by single cell method using potentiometer.
5. Determination of specific resistance by meter bridge.
6. Verify the law of resistances in series by meter bridge.
7. Verify the laws of resistances in parallel by meter bridge.
8. Determination of velocity of sound by Resonance tube.

## 5. SUGGESTED LEARNING RESOURCES

| S.No. | Author | Title | Publication and Year |
|---|---|---|---|
| 1. | Halliday D and Resnickr | Physics Part-I & II | Latest |
| 2. | Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M., | Physics Part-I & II for 10+2 Students | Latest |
| 3. | B.G. Dhande | Applied physics for polytechnics | Latest |
| 4. | Bhandarkar | Applied Physics for polytechnics | Latest |
| 5. | Saxena HC & Singh Prabhakaer | Applied Physics Vol. I & II | Latest |
| 6. | Rao, B.V.N. | Modern Physics | Latest |
| 7. | R.K.Guar and S.L. Gupta. | Engineering Physics | |
| 8. | B.L. Thereja. | Engineering Technology | |
| 9. | Modern Publishers. | ABC of Physics | |
| 10. | V.K Mehta | Elements of Electronic Engineering | |

## GN203 ENVIRONMENTAL STUDIES

### 1. RATIONALE

Due to various developmental activities carried out by man, our environment is continuously being abused and getting degraded. The air we breathe, water we drink, food we eat, land we live on, all are getting spoiled day by day. The purity of our environment is of prime importance for survival of human race on the earth. Man should not go for developmental activities at the cost of environment. This subject has been introduced in the Diploma Programme to bring about awareness towards the environmental purity amongst the students.

### 2. TEACHING AND EXAMINATION SCHEME

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| GN203 Environmental Studies | L | T | P | C | TH | TM | TW | PR/OR | 100 |
| | 3 | - | - | 3 | 75 | 25 | - | - | |

***Minimum passing %: Theory 40%*** ***Duration of Theory Paper: 3 Hrs.***

### 3. DETAILED COURSE CONTENT

**Unit 1 Multidisciplinary Nature Of Environmental Studies.**

Definition, scope and importance. Need for public awareness.

**Unit 2 Natural Resources**

Renewable and nonrenewable resources. Natural resources and associated problems.

- Forest resources: Use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, droughts, conflicts over water, dams- benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer & pesticide problems, water logging, salinity, case studies.

- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
- Land resources: Land as a source, land degradation, man induced land slides, soil erosion and desertification.

Role of an individual in conservation natural resources. Equitable use of resources for sustainable life styles.

**Unit 3 Ecosystems.**

Concept of an ecosystem. Structure and function of an ecosystem. Producers, Consumers and Decomposers. Energy flow in the ecosystem. Ecological succession. Food chains. Food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems: (a) Forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) Aquatic ecosystems (Ponds, streams, lakes, rivers, oceans, and estuaries).

**Unit 4. Biodiversity And Its Conservation.**

Introduction – Definition: genetic, species and ecosystem diversity.

Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

**Unit 5. Environmental Pollution.**

Definition. Causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, Thermal pollution, Nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of individual in prevention of pollution. Pollution case studies. Disaster management: flood, earthquakes, cyclone and landslides.

**Unit 6. Social Issues And The Environment.**

From unsustainable to sustainable development. Urban problems related to energy. Water conservation rainwater harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns; case studies. Environmental ethics: Issues and possible solutions. Climatic change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; case studies. Wasteland reclamation. Consumerism and waste products. Environmental protection act. Air (Prevention and control of pollution) Act. Water (Prevention and control of pollution) Act. Wildlife protection Act. Forest conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

| |
|---|
| **Unit 7. Human Population And The Environment.**<br>Population growth, variation amongst nations. Population explosion – Family welfare programme. Environment and human health. Human rights. Value education. HIV / AIDS. Women and child welfare. Role of Information technology in environment and human health. Case studies. |
| **Unit 8. Field Work.**<br>Visit local area to document environment assets – river / forest / grassland / hill / mountain. Visit to a local polluted site – urban / rural / industrial / agricultural. Study of common plants, insects, birds. Study of simple ecosystems – ponds, river, hill slopes, etc. (field work equal to 6 lecture hours). |

## 4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours | Marks |
|---|---|---|---|
| 1) | Multidisciplinary Nature Of Environmental Studies. | 01 | 03 |
| 2) | Natural Resources. | 10 | 12 |
| 3) | Ecosystems. | 06 | 08 |
| 4) | Biodiversity And Its Conservation. | 06 | 09 |
| 5) | Environmental Pollution. | 08 | 12 |
| 6) | Social Issues And The Environment. | 07 | 12 |
| 7) | Human Population And The Environment. | 04 | 09 |
| 8) | Field Work. | 06 | 10 |
| | | 48 | 75 |

## 5. MANDATORY ACTIVITIES

In addition to the class room instruction, visits should be arranged in any 2 of the following areas:

1. Visit to NIO or Science Centre.
2. Visit to Selaulim/ Anjunem Dam.
3. Visit to study ecosystem (Pond, Stream, River, and Forest).
4. Visit to show Hill cuttings, mining areas.
5. Visit to show Rain water harvesting project / Vermicomposting plant / Watershed management project. ( Krishi Vigyan Kendra – Old Goa)
6. Visit to water treatment/ waste water treatment plant.

## 6. SUGGESTED VIDEOS

In addition to the class room instruction, video films on environment may be shown.

## 7. SUGGESTED LEARNING RESOURCES

| S.No. | Author | Title of Books | Publication |
|---|---|---|---|
| 1 | Erach Bharucha | Textbook of Environmental Studies for Undergraduate courses | University Press |
| 2 | P. Meenakshi | Elements of Environmental Science and Engineering | Prentice Hall of India (PHI) |
| 3 | S. Deswal & A. Deswal | A Basic Course in Environmental Studies. | Dhanpat Rai & Co. |
| 4 | Pandya and Camy | Environmental Engineering | Tata McGraw Hill |
| 5 | Asthana D.K. and Asthana Meera | Environmental Problems and Solutions. | S. Chand & Co |
| 6 | Centre for Environmental education | Video Film | Thaltej Tekra, Ahme |
| 7 | Dr. S.K. Dhameja | Environmental Studies | |

## GN 205 ENGINEERING MATERIALS

### 1. RATIONALE:-

Adequate knowledge of different types of engineering materials, their properties & applications are very essential for the engineers. This course content is designed to provide basic insight knowledge regarding engineering material and their applications which will be useful for the students to learn subjects of higher semesters. The range of materials available for engineering applications is quite vast, hence only the basic groups of ferrous non-ferrous, non-ferrous & other engineering materials with their general properties and uses have been stressed upon.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **G-205** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| Engineering Materials | 4 | - | - | 4 | 75 | 25 | - | - | **100** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COURSE CONTENTS

**Unit 1 Introduction to Engineering Materials**

Classification of Materials

- Metal, Non-metal
- Ferrous Metal & Non-ferrous Metals.

Differences between Metals & non-metals.

Properties of Materials.

- Physical properties – Melting point, freezing point, boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity.
- Mechanical properties – Strength, Elasticity, Plasticity ductility,

Malleability, Toughness, Brittleness, Hardness, fatigue, creep.

- Electrical properties – Resistivity, conductivity, Temperature coeff. of resistance, dielectric strength, Thermo electricity, super conductivity.
- Magnetic properties – permeability, coercive force, magnetic stresses.
- Chemical properties - Corrosion resistance, chemical composition, acidity, alkalinity.

**Unit 2 Ferrous & Non-Ferrous Metals & its Alloys**

- **Ferrous alloys.**
  - Low carbon steel, medium carbon steel, High carbon steel, their carbon percentage, properties & uses.
  - Cast iron – Grey cast iron, white cast iron, spheroidal grey cast iron, their properties & uses.
  - Alloy steels.
    - Constituents of alloy steels such as phosphorous sulphur, Silicon, Manganese and their effect on properties of materials.
    - Stainless steel, chromium – Nickel steel, Nickel-chromium-molybdenum steel, Nitriding steel, Manganese steel, its properties & uses.
  - Tool steel – composition, HSS, High carbon steel, properties & uses.
- **Non-ferrous Metals & alloys**
  - Aluminium – Properties & uses.
  - Aluminium alloys – constituents of alloy & their effect on properties of metal
  - Properties & uses of Duralumin, Y-alloy, Al-si alloy, Al-Zn-Mg alloys.
  - Copper – Properties & uses.
  - Copper alloys – Constituents of alloy & their effect on properties of metal.
  - Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese bronze, copper-Tin alloys such as Bronze, copper aluminium alloys such as aluminium bronzes.
  - Properties & uses of lead & its alloys.

**Unit 3 Non – Metallic materials**

- Refractory
- Desirable properties.
- Difference between acid, basic & neutral refractories.
- Properties & uses of Fire clay refractory, silica refractory.
- Plastic
- Classification table only.
- Properties & uses of Thermosetting & Thermoplastic.
- Natural & Synthetic abrasive materials.
- Introduction, Properties & uses.
- Rubber
- Properties & uses of natural, neoprene, synthetic & butyl rubber.

- Vulcanization process.
  - Glass
- Properties & uses of soda glass, Borosilicate glass, fibre glass.
- Glass wool – composition, properties & uses.

  - Introduction to composite materials.Classification diagram only.

Unit 4 **Conductor, Semi Conductor, Insulating and Magnetic Materials.**

- Classification of Materials as conductor, Semiconductor and Insulating materials.
- Conductor Materials.
  - High conductivity materials
    - Copper, Aluminium, Carbon, Silver, Lead, Brass, Bronz, Tungsten & Gold.
    - Their properties as conducting materials and applications.
  - High resistivity materials
    - hichrome, constantan, manganin
    - Their applications
- Insulating materials
  - Introduction
  - Characteristics of Good Insulating materials
  - Solid Insulating materials
    - Wood, paper, rubber, mica, glass tibre, porcelain, varnish, PVC, Resins.
  - Their characteristics as insulating materials and applications.
  - Liquid insulating materials
  - Mineral oil, its properties as insulating material and applications.
  - Gaseous insulating materials like air, Nitrogen, Sulphur hexafloride & their applications.
- Semiconductor Materials.
  - Silicon & Germanium. Their specifications as semiconductor material and uses
- Magnetic Materials.

  Classification as:
  * Dia Magnetic
  * Para Magnetic
  * Ferromagnetic
  * Non magnetic

List of these materials and their applications.

**Unit 5 Construction Materials**

- Building Stones : Classification of rocks, Characteristics of good building stones, common building stones & their uses.
- Cement: Chemical composition of port land cement, outline of manufacturing process, types of cements, uses.
- Bricks: Bricks – Constituents, properties, classification, special bricks – refractory and flyash bricks; uses.
- Other materials:
  - Lime – Sources. Properties, uses.
  - Clay – Different building products from clay like tiles, pipes etc.
  - Timber – Common varieties of timber, uses wood products, veneer, plywood, etc.
  - Sand – Sources: rivers, crushed aggregates, characteristics uses.

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )**

| Unit No. | Topic | Teaching Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Introduction to Engineering Materials | **04** | **09** |
| 2 | Ferrous & Non-Ferrous Metals & its Alloys | **16** | **18** |
| 3 | Non – Metallic materials | **12** | **12** |
| 4 | Conductor, Semi Conductor, Insulating and Magnetic Materials. | **16** | **18** |
| 5 | Construction Materials | **16** | **18** |
| | | **64** | **75** |

**Semesrter -III**

| Course Code | Name Of The Course | TEACHING SCHEME | | | | EXAM SCHEME | | | | TOTAL MARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MARKS | | PR. MARKS | | |
| | | L | T | P | C | TH | TM | PR/OR | TW | |
| SH301 | Basic Ship Theory I | 3 | 1 | 3 | 7 | 75 | 25 | 0 | 50 | 150 |
| SH302 | Shop Floor Practice | 3 | 0 | 3 | 6 | 75 | 25 | 0 | 50 | 150 |
| SH303 | Marine Engineering-I | 3 | 0 | 2 | 5 | 75 | 25 | 0 | 25 | 125 |
| CS301 | Engineering Mechanics | 3 | 1 | 2 | 6 | 75 | 25 | 0 | 50 | 150 |
| CS305 | Computer Aided Drafting | 0 | 0 | 4 | 4 | 0 | 0 | 50 | 50 | 100 |
| CS302 | Elements of Electrical & Electronics Engg. | 3 | - | 2 | 5 | 75 | 25 | 0 | 25 | 125 |
| **Total** | | 15 | 2 | 16 | 33 | 375 | 125 | 50 | 250 | 800 |

## SH 301 BASIC SHIP THEORY I

### 1. RATIONALE:-

The theory course content is framed to impart knowledge to students regarding the general aspects of ship geometry, stability and numerical methods of calculating various ship forms and hydrostatic aspects. The practical content will enable the students to acquire the desired competency to prepare plan and section drawings of a ship from a given table of offsets, acquaint himself with numerical rules used in the ship related calculations and experience the calculation of fundamental hydrostatic particulars.

### 2.TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH 301** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| BASIC SHIP THEORY I | 3 | 1 | 3 | 7 | 75 | 25 | 50 | - | **150** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency -To understand types of ships, ship geometry and laws of mechanics applied to ships.

## *4.* COURSE CONTENTS

**Unit 1 Introduction to Ships**

Types of ships.

- Features and functions of cargo ships ( General Cargo Ship, Tankers, Container Ships, Bulk Carriers),
- Features and functions of Roll-on Roll-off Ships
- Features and functions of passenger vessels
- Features and functions of small craft (Hydrofoil, Hovercraft, Catamaran, SWATH, Planing Craft)
- Features and functions of sea going vessels, inland vessels, Fishing Trawlers, Barges, Dredgers, Tugs, , LPG Carriers,

Principal dimensions.

Form coefficients.

**Unit 2 . Principles of floatation**

Laws of floatation.
Effect of shifting of weights, addition, removal and suspended weights on centre of gravity.
Motions of a ship.

**Unit 3 Lines Plan**

Fairing of lines, table of offsets.

Unit 4 **Integration rules**

Simpson's rule, Simpson's 5,8,-1 rule, Trapezoidal rule, Tchebycheff's rule. Application of integration rules in determining areas, volumes, centroids, first moments and moment of inertia of waterplanes of ships.

**Unit 5 Small Angle Stability**

Types of equilibrium. Initial stability: - Heeling and righting moments. Statical stability curve-Range of stability, initial GM, maximum GZ, angle of vanishing stability, Point of inflexions. Down flooding angle. Effect of various factors on stability-Calculations of free surface effect. Longitudinal stability and trim.

**Unit 6 Inclining Test**

Purpose and procedure of inclining experiment. Determination of center of gravity – Inclining experiment. Precautions in conduct of inclining experiment. Confirmation of correctness of results of the test.

**Unit 7 Bonjean and hydrostatic curves**

Determination of volume of displacement, LCB, VCB from Bonjean curves. VCB/KB, KM, LCF, LCB, CB, CP, CVP, CM, CWP, MCT, TPC and displacement curves

### 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Introduction to Ships | **04** | **07** |
| 2 | Principles of floatation | **05** | **08** |
| 3 | Lines Plan | **02** | **06** |
| 4 | Integration rules | **10** | **12** |
| 5 | Small Angle Stability | **12** | **18** |
| 6 | Inclining Test | **04** | **06** |
| 7 | Bonjean and hydrostatic curves | **11** | **18** |
| | | **48** | **75** |

### 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different types of skills leading to the achievement of the competency –Development of lines plan and Bonjean curves.

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 3 | Lines plan drawing – Table of offsets and body plan |
| 2 | 3 | Lines plan drawing – half-breadth plan |
| 3 | 3 | Lines plan drawing –profile view (buttock lines), diagonal. |
| 4 | 3 | Fairing of lines |
| 5 | 3 | Lines plan drawing -Use of ship design software |
| 6 | 4 | Bonjean calculation |
| 7 | 4 | Bonjean curves |
| 8 | 4 | Bonjean calculation & Bonjean curves:Use of ship design software |
| 9 | 5 | Inclining experiment on model. |

**7. SUGGESTED LEARNING RESOURCES**

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | Derett, D. R | Ship Stability for Masters and Mates | Stanford Maritime |
| 2 | John P. Comstock | Principles of Naval Architecture | SNAME |
| 3 | Munro-Smith | Ships and Naval Architecture | Institute of Marine Engineers |
| 4 | Rawson, K.J. and Tupper E. | Basic Ship Theory, Vol I & II | Longman |
| 5 | Baxter, B. | Naval Architecture Examples and Theory | Charles Griffin & Co |
| 6 | Thomas, Gillmer C. | Introduction to Naval Architecture | E & F.N. Spon |
| 7 | Munro – Smith, R | Naval Architecture for the Merchant Navy Exams | Technical Press |
| 8 | Stokoe, E.A. | Reed's Naval Architecture for Marine Engineers | Thomas Reed Publisher Ltd.) |
| 9 | Muckle. W | Naval Architecture for Maritime Engineers | Butter Worths |
| 10 | Hogg, Robert S. | Naval Architecture and Ship Construction | Institute of Maritime Engineers |

## SH 302 SHOP FLOOR PRACTICE

### 1. RATIONALE:-

As a supervisor in Shipbuilding Engineering Industry, student should know the working principle of various machines used by the Industries, their work range, tools used for different operations. The commonly used machines in Industry are dealt here. Enough practical exposure is also given to develop minimum skill to perform various operations. The student should be able to select the proper machine and proper tool for a particular operation. The student should be able to perform a given operation on a particular machine and take care of safety of men, machine and tools.

### 2.TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH 302** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | **150** |
| SHOP FLOOR PRACTICE | 3 | 0 | 3 | 6 | 75 | 25 | 50 | - | |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skills leading to the achievement of competency – To understand the construction, working operations on different machines used in shipbuilding yards and ships

## *4.* COURSE CONTENTS

| | |
|---|---|
| **Unit 1:** | **Lathe Machine**<br><br>Introduction, different parts of Lathe and its specification, Methods of taper-turning – their advantages and limitations. Thread cutting on lathe. Accessories used on lathe, different tool materials and cutting fluid. |
| **Unit 2:** | **Drilling Machine**<br>Introduction, types of drilling machines. Construction and working of Pillar drilling machine & Radial drilling machine. Work holding devices, Tool holding devices. Operation of drilling machine. Tools used on drilling machine. |
| **Unit 3:** | **Boring machine**<br>Introduction, Types of Boring machines, Boring Mechanism, Parts of Horizontal Boring machine, Horizontal boring machine operations, Boring tool mountings for horizontal boring machine. |
| **Unit 4:** | **Shaping machine**<br>Introduction, Types of shaping machine. Main parts and their functions. Work holding devices. Shaper operations. |
| **Unit 5:** | **Milling machine**<br>Introduction. Types of milling machines. Operation carried out on milling machine. Types of milling cutters. Milling machine attachment. |
| **Unit 6:** | **Press and press work**<br>Introduction. Types of presses. Construction and working of fly press. Power press-driving mechanisms. Press tools. Types, dies and operations on press. |
| **Unit 7:** | **Bending machine**<br><br>Introduction, factors involved in bending, types of bending machines-Plate bending, plate rolling, angle bending and pipe bending, heating and bending application. Three-dimensional bending for ship construction. |
| **Unit 8:** | **NC & CNC Machines**<br>Introduction and Classification of NC machines. Nominal control system, Measuring system for control, preparation of processing system. Programming and tape preparation. Introduction to CNC machines. |

### 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | Lathe Machine | **10** | **15** |
| 2 | Drilling Machine | **06** | **10** |
| 3 | Boring Machine | **06** | **10** |
| 4 | Shaping Machine | **06** | **08** |
| 5 | Milling Machine | **06** | **10** |
| 6 | Press & Press Work | **06** | **10** |
| 7 | Bending Machine | **04** | **06** |
| 8 | NC & CNC Machine | **04** | **06** |
| | | **48** | **75** |

### 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of the competency –Preparing different types of Jobs on various machines used in shipyards and ships

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | **1** | Introduction to various machinery. |
| 2 | 1 | One job involving facing, plain turning, step turning , taper turning and external threading. |
| 3 | 1 | One job involving internal 'V' threading (Demonstration). |
| 4 | 2 | One job involving Drilling operation. |
| 5 | 4 & 5 | One job involving Shaping & Milling operation. |
| 6 | 7 | One job in Pipe Bending(Demonstration). |
| 7 | 6 | One job involving Press Operation(Demonstration). |
| 8 | 8 | Demonstration of CNC Machines. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | S.K.Hajra Choudhary, S.K Bose & A.K.Aajra Choudhary. | Elements of workshop Technology Vol-II | Media Promotions & Publishers Pvt. Ltd. |
| 2 | Suresh Dalala. | Manufacturing science & Technology Vol-II | Umesh Publications |
| 3 | K.N. Gupta & J.P. Kaushish | Workshop Technology Vol-II | New Heights Publishers |
| 4 | H.S. Bawa | Workshop technology Vol-II | Tata Mcgraw Hill Publication Company Ltd. |

## SH 303 MARINE ENGINEERING I

### 1. RATIONALE:-

It is essential that as engineers involved in shipbuilding and ship have a thorough knowledge of pipeline system with fittings, type of valves and their selection, types of Marine pumps, boilers types, diesel engines working cycles and components. Having studied this subject, a student shall be able to choose material for pipes depending on ship systems for installation on board. Select valves for particular applications. Know various types of boilers in Marine usage, with mountings, accessories and basic installation features.

### 2.TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH 303** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| MARINE ENGINEERING I | 3 | 0 | 2 | 5 | 75 | 25 | 25 | - | **125** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to achievement of competency – To understand piping system, types of pipes, valves, pumps and the various boilers and compressors used in Shipbuilding.

## *4.* COURSE CONTENTS

**Unit 1. Pipes**

Ship pipelines, their material, fittings, methods of joining pipes, expansion joints, jointing, strainers, steam traps, care of piping.

**Unit 2: Valves**

Types of valves used-on-board and their applications- globe valve, gate valve, relief valve, quick closing valve, reducing valve, valve chests, shipside valves and their requirements, storm valve, butterfly valve, ball valve and Cocks. SD and SDNR valve. Detailed sectional drawing of globe valve, gate valve and butterfly valve only

**Unit 3: Fluid Pumps**

Types of pumps – Characteristics and Marine applications of reciprocating, centrifugal, rotary pumps used on ships. Definition and terminology, impeller characteristics, safety features, care and maintenance of pumps, testing of pumps, starting and stopping of pumps.

**Unit 4. Ship Systems**

Ship piping systems i.e bilge and ballast, fresh water, hydrophore, steam piping, fuel oil and lubricantion oil systems, compressed air piping, fire fighting mains.

**Unit 5. Marine boilers**

Classification of boilers in Marine applications- Main, Auxilary, Exhaust gas, Composite boilers and Packaged boilers (detailed construction not included). Fire tube and water tube boilers. Mountings and accessories and safety features. Air supply and fuel supply.

**Unit 6. Compressors**

Types- Reciprocating – single and multistage, centrifugal and rotary, Constructional features of reciprocating compressor only. Applications of compressors. Air receivers and mountings. Safety features.

## 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | Pipes | **09** | **12** |
| 2 | Valves | **08** | **12** |
| 3 | Fluid Pumps | **09** | **16** |
| 4 | Ship Systems | **11** | **18** |
| 5 | Marine boilers | **06** | **09** |
| 6 | Compressors | **05** | **08** |
| | | **48** | **75** |

## *6. SUGGESTED LIST OF EXPERIMENTS*

The assignment should be properly designed and implemented with an attempt to develop the different types of skills leading to the achievement of competency –To understand the different types of pipes , pipe fittings, valves, piping systems, boiler mountings and a compressor.

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | To study pipeline fitting i.e. Elbows, Tees, Unions, Sockets, Reducers, Bulkhead/Deck piece, Flange joint. |
| 2 | 1 | To identify different jointing materials and gland packing. |
| 3 | 2 | To dismantle and assemble various types of valves i.e. globe valve, non return valve, butterfly valve, quick closing valve |
| 4 | 3 | To dismantle assemble & study principle of working of reciprocating, centrifugal, rotary & semi rotary pumps |
| 5 | 5 | To study boiler mountings |
| 6 | 6 | Study of reciprocating air compressor. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | D.A. Taylor | Introduction to Marine Engg | Butterworths, 1983, The University press, Cambridge. |
| 2 | David D Smith | Marine Auxiliary Machinery | Butterworths, London. |
| 3 | H. James Milton & M. Roy Leach | Marine Steam boiler | (Butterworths) |
| 4 | C. C. Pounder | Marine Diesel Engines | Butterworths, London. |
| 5 | Harrington | Marine Engineering | Sname, New York. |

## (CS301) ENGINEERING MECHANICS

### 1. RATIONALE.

The focus of the course is to study rigid bodies, subjected to motion or equilibrium with the particular emphasis of engineering applications. This course plays a key role in engineering and is a pre- requisite for all design applications. Basic understanding of the concepts and principles involved in mechanics is essential. The concepts in Applied Mechanics form the base of all engineering disciplines. Applications of principles to engineering situations is emphasized in this course. Considering the level of student, concepts are difficult; hence classroom demonstration should be used to explain concepts and principles.

### 2.

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| CS301 | L | T | P | C | TH | TM | PR /OR | TW | |
| Manufacturing Processes-I | 3 | 1 | 2 | 6 | 75 | 25 | - | 50 | 150 |

Minimum passing % : Theory 40% and Practical 40% Duration of Theory Paper: 3Hrs

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE.

The course content should be taught and implemented with the aim to appreciate and apply the Principles and Laws of Engineering Mechanics in basic Engineering Design concepts.

### 4. DETAILED COURSE CONTENT

**CH1. FORCE** **09 Mrks** **05hr**

Definition & units of Force, Types of Forces, its Characteristics, Effect of Forces,

System of Forces, Resolution & Composition of Forces (Resolving along X & Y Axis only).

Relationship between Resultant & Equilibrant Force.

Application of Resolution to find Resultant of coplanar concurrent Force System, and Finding missing force when resultant is given.

**CH2. MOMENTS** **09Mrks** **04hrs**

Definition and units, Sign conventions (Take clockwise +ve, Anticlockwise -ve)

Definition & units of couple (clockwise +ve, Anticlockwise -ve)

Characteristics of couple, Varignon's Theorem,

Application of above to find Resultant in magnitude, direction and line of action in Coplanar Non- concurrent and parallel Force system.

**CH.3 EQUILIBRIUM** **18Mrks** **12hrs**

Concepts of Equilibrium,Conditions of Equilibrium for Two forces, Three forces, concurrent & non concurrent force system, Lami's Theorem and its application..

Concepts and drawing of Free Body Diagram involving not more than three bodies.

Definition of Beam, types of beams, types of Supports and types of loading.

Application of Equilibrium to beams ( Beams with two supports at the ends, Beams with overhangs) with Concentrated loading, UDL, Partially UDL Loading only.

Applications of Equilibrium to determine the forces in the member of the perfect simple support and cantilever truss using method of Joints. Graphical method/ Maxwell diagram for determination of forces in the member of truss.

**CH.4 FRICTION** **09Mrks** **06hrs**

Definition, Coulombs Law of static friction, coefficient of friction, Angle of friction, Cone of friction, Angle of Repose

Application of Friction with a block on horizontal and inclined Plane , Ladder friction.

**CH.5 KINETICS** **12Mrks** **09hrs**

D'Alemberts Principle and its Application

Simple problems related to Motion of Lift, Two connected bodies with a single string, suspended on horizontal and inclined planes.

**CH.6 MOMENTUM, IMPACT, AND IMPULSE** **06Mrks** **04Hrs**

Definition and units of Momentum and Impulse

Definition of impulsive force

Law of Conservation of Momentum.

Simple problems related to Momentum and Impulse, impulsive force, Law of Conservation of Momentum

**CH.7 WORK, POWER & ENERGY** **12Mrks** **08Hrs**

Definition and units of Work, Power and Energy.

Forms of Energy – Kinetic and Potential Energy.

Principle of Conservation of Energy

Simple numerical problems to calculate Work, Power, Energy & conservation of Energy.

**Total = 75 Mrks** **48 Hrs**

**Engineering Mechanics (Practicals)**

**Experiments:- (Minimum 06 experiments)**

1. To Verify Polygonal Law of forces.

2. To Prove Lami's Theorem.

3. To find Co-efficient of Friction.(Any Two Surfaces)

4. To Determine Reactions in Beam Apparatus.

5. Four experiments on Lifting Machine to find M.A, V.R , Efficiency, and to obtain Law of Machine

**Graphical Analysis:** - 3 sheets (Half Imperial)

a) Determination of Resultant of Coplanar Concurrent Forces.

b) Determination of Resultant of Coplanar, Non-concurrent Forces and Parallel.

c) Analysis of Trusses (Simply supported and Cantilever) using Maxwell diagram.

**Reference Books :-**

1. Fundamental of Applied Mechanics – Dadhe, Jamdar, Walavaikar

2. Applied Mechanics – R.S. Khurmi

3. Engineering Mechanics – A.R. Basu

4. Applied Mechanics Vol-I – R.C. Patel & B.M. Patel

# (CS 302) ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

**1. RATIONALE:**

A Mechanical Engineering Diploma holder in his job in industry has to interact with many electricalmachines and electronics based controls in operation of various machine tools and machine control systems. Therefore a basic knowledge about electrical and electronics engineering relevant to his job requirement of operation and maintenance in industry is mandatory to perform his job efficiently.

**2. TEACHING AND EXAMINATION SCHEME:**

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| | L | T | P | C | TH | TM | TW | PR/OR | |
| ELEMENTS ELECTRICALAND ELECTRONICS ENGINEERING. | 3 | - | 2 | 5 | 75 | 25 | 25 | - | 125 |

**Minimum passing % :**Theory 40% **Duration of Theory Paper:** 3 Hrs.

**Legends:**

**L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:**

**PR/OR - End Semester Practical / Oral Examinations; TW- Term Work**

**3. Unit- I–AC Fundamentals (2hrs) (3marks)**

Sinusoidal AC voltage waveform.

Definition of terms related to AC wave-- average value, RMS value.

Definition of power factor and its significance.

**Unit- II – Distribution of Electrical Energy (9hrs) (15marks)**

Voltage levels in the various stages in the flow of electrical power from 110KV substation to 11KV/440V distribution transformer(using single line diagram only).

Method of laying underground cables for distribution of power.

Voltage levels for commercial and domestic use.

Conduit wiring system- surface and concealed, its advantages and disadvantages.

Definition of Earthing, its necessity .
Types of Earth electrodes—Pipe and Plate electrode.
Methods of reducing earth resistance.

**Unit- III – Cables , Switching and Protective Devices (8hrs) (15marks)**

Construction of three phase PVC insulated power cables.
Specifications of PVC cables.
Colour codes of single phase and three phase PVC cables.
Functions and symbols of Switch-Fuse Unit, Fuse-switch Unit, Contactors, MCB, MCCB and ELCB.
Fuses- Construction and Applications of Rewirable fuses and HRC fuses.
Construction and operation of a simple electromagnetic relay and limit switches.

**Unit- IV – Transformers (4hrs) (06marks)**

Principle of operation and basic construction of a single phase transformer (core and winding only).

EMF equation(no derivation and no numericals).

Losses in a transformer, efficiency and voltage regulation(no derivation and nonumericals).

Significance of KVA Rating of transformer.

**Unit- V – DC Motors (6hrs) (09 marks)**

Working principle of DC motors, main parts of DC motor and their functions,.

Classification of DC motors (shunt, series and compound and their applications).

Necessity of a starter for DC motors (No study of starters).

Methods of reversal of direction of rotation of DC shunt and series motor.

**Unit- VI – AC Machines (6hrs) (09marks)**

Principle of operation of three phase induction motor.

Main parts of three phasesquirrel cage & Slip Ring Induction motors.

Applications of induction motors.

Necessity of starter, Names of starters used, reversal of direction of rotation.

Working principle of an alternator.

**Unit- VII – Basic Electronic Devices (9hrs) ( 12marks)**

Semiconductor theory-Construction of Intrinsic and extrinsic semiconductor, P and N type semi conductors, working principle of Diode, diode V-I characteristics, Full wave centre-tap and bridge rectifiers- circuit diagram,operation and waveforms, capacitor filter to reduce ripple voltage.

Transistor -NPN and PNP, construction , symbol and operation. Transistor CE Amplifier-circuit diagram and operation using waveforms only. Applications of transistors (naming only)

**Unit- VIII – Digital Logic Gates (5hrs) (06marks)**

Binary number system, Symbols and Truth Tables of AND, OR,NOT,NAND,NOR,X-OR,X-NOR Gates

## 4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

| Unit No. | Unit | Teaching Hours / Semester | Marks |
|---|---|---|---|
| 1 | AC Fundamentals | 2 | 03 |
| 2 | Distribution of Electrical Energy | 9 | 15 |
| 3 | Cables,Switching and Protective Devices | 8 | 15 |
| 4 | Transformers | 4 | 06 |
| 5 | DC Motors | 6 | 09 |
| 6 | AC Machines | 6 | 09 |
| 7 | Basic Electronic Devices | 8 | 12 |
| 8 | Digital Logic Gates | 5 | 06 |

## 5. SUGGESTED LIST OF EXPERIMENTS

**(Any 8-10)**

| Sr. No. | LIST OF EXPERIMENTS |
|---|---|
| 1 | Identification of various components of a Diesel-Engine Generator set and study its operation. |
| 2 | Connection of a single phase Transformer and measurement of Input and Output voltages, currents and power for different loads. |
| 3 | Simulation of fuse failure on any one primary phase of a 3-phase transformer and study its effect on the secondary voltages. |

| | |
|---|---|
| 3 | Connection, Starting, speed controland reversal of direction of rotation of DC shunt motor |
| 4 | Connection and Starting of three phase induction motor using manual and automatic star delta starter |
| 5 | Connection, starting, running and speed control of Slip Ring induction motor |
| 6 | Calculations for selection of PVC cables for different currents. |
| 7 | Identification of Fuses ,MCBs and ELCBs and study of operation of MCB and ELCB for different simulated faults. |
| 8 | Circuit assembly, measurement of input and output voltages and fault simulation and trouble shooting of Bridge and Centre-tap Rectifiers |
| 9 | Circuit assembly for ON/OFF control of single phase loads such as lamps, home appliances,etc. using transistorized circuit and a Relay. |
| 10 | Verification of truth tables of Logic Gates |

## 6. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title | Publication and Year |
|---|---|---|---|
| 1 | B.L. Thereja. | Text book of Electrical Technology | Latest |
| 2 | V.K. Mehta | Principles of Electronics Engineering | Latest |

## (CS 305) COMPUTER AIDED DRAFTING

### 1. RATIONALE:

The market driven economy demands frequent changes in product design to suit the customer needs.With the introduction of computers the task of incorporating frequent changes as per requirement is becoming simpler. This course has been introduced at Diploma level to develop the skills in student so that they can generate various digital drawing s as required using various CAD software.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| CS305 Computer Aided Drafting | L | T | P | C | TH | TM | TW | PR/OR | 100 |
| | | | 4 | 4 | - | - | 50 | 50(P) | |

### 3. COURSE CONTENTS:

1. Introduction and CAD Preliminaries. 2 hours
   - Computer aided drafting concept.
   - Hardware and various CAD software available.
   - Components of a CAD software window such as Titlebar, Standard toolbar, Menu bar, Object properties toolbar, draw tool bar, Modify toolbar, Cursor cross hair, Command window, status bar, Drawing area,UCS icon.
   - File features: New file, Saving the file, Opening an existing drawing file, Creating Templates, Import and Export of file, Quit.

| |
|---|
| • Setting up new drawing : Units, Limits, Grid, Snap.<br>• Undoing and Redoing action. |

| |
|---|
| 2. Drawing using CAD software: 10 hours<br>• Drawing basic objects : Point, Line, Circle, Arc, Ellipse, Parabolas, polygon, Rectangle, Multiline, Doughnut, Drawing with precision, Drawing construction lines and rays, Calculating distance and angle, Use of measure, Divide, Inquiry commands, redraws and Regenerating screen display.<br>• Methods of specifying points, Absolute coordinates, Relative Cartesian, and Polar coordinates.<br>• Using Object snap: Endpoint, midpoint, Intersection, Centre Point, Quadrant point, Nearest Perpendicular, Apparent Intersection, etc. |
| 3. Edit/modify features and viewing drawings. 10 hours<br>• Object Selection : selection set with its options like Pick box, Window, Crossing, Previous, Last drawing, etc.<br>• Editing Commands like : Zoom all, Zoom Previous, Zoom Extents, Zoom window, Zoom real time, Zoom Dynamic, Zoom Pan.<br>• Modify commands: Erase, Copy, Mirror, Offset, Array, Move, Scale, Stretch, Lengthen, Trim, Extend, rotate, break, join, chamfer, fillet. |

4. Organising Drawing: 6 hours

- Concepts of layers: creating layers, naming layers. making layers ON/OFF, freeze-thaw layers, lock/unlock layers, setting the properties of layers like colour, line type, line weight.
- Concept of blocks : Creating, inserting, redefining and exploding blocks.
- Concept of Hatch: Selecting hatch pattern, Hatch styles, Hatch Orientation, associative hatch, Boundary hatch, Hatching Object.
- Polylines: Drawing polylines, editing polylines, drawing spline curves, editing splines.

| | |
|---|---|
| 5. Dimensioning and Tolerancing<br>hours<br>• Dimensioning : Types of dimensioning, Linear, Horizontal, Vertical, Aligned, rotated, Baseline, continuous, diameter, radius, angular dimension, Leader.<br>• Dimension scale variable,adding geometric tolerances<br>• Editing dimensions<br>• Single line text,Multiline text.<br>• Text styles: selecting font, size, arrows, alignment, etc. | 8 |
| 6. 3D-features<br>hours<br>• Right hand rule/local global co-ordinate system.<br>• Specifying 3D coordinates<br>• Using UCS<br>• Defining user coordinate system using UCS command with its options.<br>• Viewing in 3D | 2 |
| 7. Isometric Drawing:<br>hours<br>• Settings for isometric drawing, isometric Snap mode, switching between isometric planes, isocircles, simple isometric drawings | 10 |

| | |
|---|---|
| 8. Solid Modeling<br>hours<br>• Concept of solid modeling<br>• Creating predefined solid primitives such as box, cone, cylinder, sphere, torus, wedge.<br>• Constructing a region, creating an extruded solid, creating a revolved solid.<br>• Creating composite solids using union, intersection and interface commands. | 12 |
| 9. Model space, Paper space, viewports and layouts<br>hours<br>• Concept of model space and paper space.<br>• Creating viewports in model space and creating floating viewport in paper space.<br>• Shifting from model space to paper space and vice versa. | 2 |
| 10. Printing/ Plotting drawing.<br>hours<br>• Standard sizes of sheet.<br>• Selecting various plotting parameters such as paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview. | 2 |

## 4. PRACTICALS

1. Drafting of common template for all the following assignments with Institute logo and standard title block.
2. Five problems on different geometrical shapes.
3. Dimensioning of above figures.
4. Three problems with polar and rectangular arrays.
5. Three problems on 2D entity generation, which involve the use of layers and blocks.
6. Two problems on orthographic views for various Engineering drawing objects covering dimensioning, text, etc.
7. Two problem on isometric drawing of Engineering drawing object.
8. Create at least two solid models, which cover all the features available in solid modeling.
9. Drafting project:
    a) Civil Engineering. & Architectural Engineering: Plan, elevation and section of a single story residential building.
    b) Electrical & Electronics Engineering.: Electrical layout of components like bulbs, fan, A.C., T.V. point, telephone point, etc. for a single story house.
    c) Mechanical Engineering.: Industrial components such as machines, automobiles , jigs and fixtures with dimensioning, tolerancing ,text, title block, etc.
    d) Shipbuilding Engineering.: Body plan of a ship.
    e) Mining Engineering.: Plan and section of an opencast mine benches, Plan and section of an underground mine.
    f) F.T.E.E. : Front View and Bottom View of a Simple truss like Saw Tooth truss, King-Post truss, Snow Tooth truss. (Any one of the three)

## 5. LEARNING RESOURCES

1. AutoCAD for Engineering drawing made easy – P. Nageshwar Rao- Tata McGraw Hill.
2. Mastering AutoCAD – George Omura- BPB Publication.
3. AutoCAD 2004 – Sham Tickoo- Galgotia Publications, New Delhi.

4. AutoCAD 2000 – Devid Frey- BPB Publication.
5. An Introduction to AutoCAD 2000 – A. Yarwood- Longman publication.
6. Using AutoCAD 2000 – Ron House – Prentice Hall.
7. Latest AutoCAD Manual – Autodesk Inc. – Autocad Inc.
8. CATIA V6 Essentials by Jones & Bartlett learning.
9. Inside Catia by Paul Carman, Paul Tigwell.
10. CATIA Tutorials by Nader G. Zamani.
11. ProE/Creoelements or any equivalent reference/text books.

# Semester-IV

| Course Code | Name Of The Course | TEACHING SCHEME | | | | EXAM SCHEME | | | | TOTAL MARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MARKS | | PR. MARKS | | |
| | | L | T | P | C | TH | TM | R/O | TW | |
| SH401 | Basic Ship Theory II | 3 | 0 | 3 | 6 | 75 | 25 | 0 | 50 | 150 |
| SH402 | Marine Engineering - II | 3 | 0 | 2 | 5 | 75 | 25 | 0 | 25 | 125 |
| SH403 | Welding In Ship Construction | 3 | 0 | 3 | 6 | 75 | 25 | 0 | 50 | 150 |
| SH404 | Introduction to Thermodynamics | 3 | 1 | 1 | 5 | 75 | 25 | 0 | 25 | 125 |
| SH405 | Ship Construction Technology | 3 | 0 | 2 | 5 | 75 | 25 | 0 | 25 | 125 |
| ME401 | Strength Of Materials | 3 | 1 | 2 | 6 | 75 | 25 | 0 | 25 | 125 |
| | Total | 18 | 2 | 13 | 33 | 450 | 150 | | 200 | 800 |

## (SH401) BASIC SHIP THEORY II

### 1. RATIONALE:-

The courses contents will enable students to have sufficient knowledge of stability at large angles, damaged conditions, capacity calculations, measurement of tonnage, load line assignment, launching operation, and strength of ships. The practical is designed so that the pass-outs will be able to perform basic hydrostatic and capacity calculations, launching curves and estimation of steel weight for simple structure.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH 401** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| BASIC SHIP THEORY II | 3 | 0 | 3 | 6 | 75 | 25 | 50 | - | **150** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to achievement of competency -To understand intact and damaged stability, capacity calculations, strength calculations, Tonnage and freeboard Calculations.

*4.* **COURSE CONTENTS**

**Unit 1. Large angle stability**

- Statical stability curve-Range of stability, initial GM, maximum GZ, angle of vanishing stability, Point of inflexion. Cross curves of stability. Determination of GZ curve from cross curves.
- Atwood's and wall-sided formula, dynamical stability

**Unit 2. Capacity**

Stowage factor, bale and grain capacity, capacity plan.

**Unit 3. Damage Stability**

Permeability, margin line, subdivision, floodable length and permissible length. Added weight and lost buoyancy method. Effect of flooding. Determination of draft, list, trim and stability after flooding for vessels of simple configuration. Probabilistic treatment of subdivision and damaged stability for cargo ship. Application of damage stability for cargo ships and passenger ships.

Unit 4. **Strength of ships**

Longitudinal strength-weight curve, buoyancy curve, sheer force and bending moment diagrams for still water condition. Calculation of hull girder section modulus and stresses induced on deck and keel-Check on mid-ship section modulus. Wave bending moment.

**Unit 5. Launching**

Principles and types of launching. Pivoting and tipping. Side and end launching. Launching curves and Characteristics. Launching from graving dock, floating dock and ship lift.

## 6. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Large angle stability | **13** | **21** |
| 2 | Capacity | **04** | **06** |
| 3 | Damage Stability | **10** | **15** |
| 4 | Strength of ships | **15** | **24** |
| 5 | Launching | **06** | **09** |
| | | **48** | **75** |

## 7. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of the competency –Hydrostatic Calculations, generation of hydrostatic curves, capacity plan, launching curves, weight curves and freeboard calculations

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | Hydrostatic calculation and hydrostatic curves – Displacement, form coefficients, longitudinal center of buoyancy, metacentre radii, TPC, MCT. |
| 2 | 2 | Capacity calculation and Capacity plan. |
| 3 | 5 | Launching calculations and launching curves. |
| 4 | 4 | Estimation of steel weight, LCG, VCG of structures with simple configuration and distribution of steel weight. |

## 8. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | Derett, D. R | Ship Stability for Masters and Mates | Stanford Maritime |
| 2 | John P. Comstock | Principles of Naval Architecture | SNAME |
| 3 | Munro-Smith | Ships and Naval Architecture | Institute of Marine Engineers |
| 4 | Rawson, K.J. and Tupper E. | Basic Ship Theory, Vol I & II | Longman |
| 5 | Baxter, B. | Naval Architecture Examples and Theory | Charles Griffin & Co |
| 6 | Thomas, Gillmer C. | Introduction to Naval Architecture | E & F.N. Spon |
| 7 | Munro – Smith, R | Naval Architecture for the Merchant Navy Exams | Technical Press |
| 8 | Stokoe, E.A. | Reed's Naval Architecture for Marine Engineers | Thomas Reed Publisher Ltd.) |
| 9 | Munro-Smith, R. | Element of Ship Design | Marine Media Management |
| 10 | Muckle. W | Naval Architecture for Maritime Engineers | Butter Worths |
| 11 | Corkhill, Micheal | Tonnage Measurement of Ships | Fairplay Publication |
| 12 | Robert Taggart | Design and Construction | SNAME |
| 13 | White G. W. | Elementary Beam Theory and The Ship Girder | Stamford Maritime |

## (SH402) MARINE ENGINEERING II

### 1. RATIONALE:-

Engineers involved in shipbuilding, ship repairs, and operation, are required to have a thorough knowledge of diesel engines, steam turbine, marine gears, stern gears. Having studied this subject, student shall be able to prepare sketches of diesel engine components and trace system integral with diesel engine. They should understand principle of operation, constructional details of steam turbines. They should study types of stern gear for inland & ocean going vessels. Engineers involved in shipbuilding should understand various types of deck machinery drives and their positions and installations. Due importance has also been given to fire protection system, ventilation, air-conditioning and refrigeration system. They should understand basic concepts and applications of Electrical Machinery. They should know different types of steering gear i.e. mechanical, hand hydraulic, Electro hydraulic.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH 402** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| Marine Engineering II | 3 | 0 | 2 | 5 | 75 | 25 | 25 | - | **125** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

## 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency – To understand the diesel engine terminology, components, systems and other systems like deck machinery, electrical systems, steering gear and air conditioning –refrigeration systems.

## *4.* COURSE CONTENTS

**Unit 1. Diesel Engines**

- S
  cope, description, types, marine uses.
- D
  iesel Engine Systems
  Engine Cooling system, engine fuel oil system, engine lubricating oil system, basic engine air starting systems, scavenging and super-charging, methods of supercharging and turbochargers
- B
  asic features of principal components of diesel engines, e.g cylinder head, cylinder liner, pistons, cross-heads, connecting rods, camshafts with drives, crank shafts, tie rods, bed-plate, main bearing, top end and bottom end bearings and thrust bearing.
- S
  afety features used in diesel engine- High cooling water temperature, low lub oil pressure, engine overspeed and crankcase mist detector.

**Unit 2: Ventilation, Refrigeration and Air conditioning**

Ventilation-Natural and forced, Principle of vapour compression refrigeration cycle, basic features and functions of equipment involved i.e compressor, condenser, expansion valve and evaporator. Air-conditioning. Provision chambers. Brine refrigeration system, and cargo hold conditioning.

**Unit 3: Deck Machinery**

Types of drives- electrical, electro-hydraulic, deck machinery positions and installation, working principle of anchor windlass, cargo and mooring winches, cargo handling crane, capstans, and hatch cover operating machinery.

**Unit 4. Steering Gear**

Types of steering gear-mechanical, hand hydraulic, and power electro hydraulic-actuators including rotary. Construction and operation, control system and statutory requirements.

**Unit 5. Electrical Machinery Onboard**

**Basic concepts and applications** of Electrical Machinery – alternators, motors, main switch board, transformer and distribution system, emergency source of power, preferential tripping, protective devices, shore connection and inter lock.

## 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | Diesel Engines | **20** | **32** |
| 2 | Ventilation, Refrigeration and Air conditioning | **10** | **16** |
| 3 | Deck Machinery | **08** | **12** |
| 4 | Steering Gear | **04** | **06** |
| 5 | Electrical Machinery Onboard | **06** | **09** |
| | | **48** | **75** |

## 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of the competency — To understand the diesel engine components, systems and other systems like deck machinery, electrical systems, steering gear and air conditioning –refrigeration systems.

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | To prepare sectional sketches of important diesel engine components- bed plate, cylinder liner, piston, and cylinder head.<br>Line sketch of engine structure |
| 2 | 1 | To prepare line sketches of fuel oil, lubricating oil, cooling water and starting air circuits from an actual diesel engine |
| 3 | 2 | To prepare sketches of natural and forced draft vents. |
| 4 | 2 | To prepare line sketch of vapour compression refrigeration system with equipment. |
| 5 | 3 | To visit inland vessels/ocean going vessels and prepare deck machinery layout with their position, brief description about working, line sketches of systems incorporated. |
| 6 | 3 | To visit inland vessel/ocean going vessel and prepare machinery space layout |

| | | |
|---|---|---|
| 7 | 4 | To visit shipyard for sketching of physical arrangement of steering gear for inland/ ocean going vessels. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | D.A. Taylor | Introduction to Marine Engineering | Butterworths. |
| 2 | David D. smith | Marine Auxilary Machinery | Butterworth, London |
| 3 | Dirnie, S-G | Marine Steam Engine & Turbines | Butterworth, London |
| 4 | C.C. Pounder | Marine Diesel Engines | Butterworth, London |
| 5 | Harrington | Marine Engineering | SNAME – New York |

## (SH403) WELDING IN SHIP CONSTRUCTION

### 1. RATIONALE:-

It is essential that a technician involved in shipbuilding, ship repair industry should have a thorough knowledge of different welding processes, which plays vital role in fabricating different metals and non- metals. Hence an attempt has been made in Welding in ship construction to brief out different welding processes, welding processes, types of welding joints, etc.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH 403** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| WELDING IN SHIP CONSTRUCTION | 3 | 0 | 3 | 6 | 75 | 25 | 50 | - | **150** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*
***Legends:***
***L****-Lecture;* ***T*** *- Tutorial;* ***P*** *- Practical;* ***C****- Credit;* ***TH****- End Semester Theory;* ***TM*** *– Test Marks:*
***PR/OR*** *- End Semester Practical / Oral Examinations;* ***TW-*** *Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency –To understand different processes of welding equipments, safety precautions, weld positions & different methods of weld evaluation

### *4.* COURSE CONTENTS

| |
|---|
| **Unit 1. Introduction to welding**<br><br>Definition of Welding. Classification of different welding processes. Advantages and Disadvantages of welding. Weldability of steel and carbon equivalent. Comparison of welding with respect to casting. |
| **Unit 2: Safety in Welding**<br><br>Health and safety of the worker. Safe welding practices. |
| **Unit 3: Welding Equipments & welding Processes**<br><br>Gas welding MMAW Process (Equipments & details) - TIG Welding Process (Equipment and details), MIG/MAG Welding process (Equipment and details), Submerged Arc Welding Process (Equipment and details).Welding of Alluminium. |
| **Unit 4. Welding electrodes and consumables**<br><br>Types of welding electrodes (consumable and non consumable), classification of electrodes, electrode coating. Selection of electrodes. Care and storage of electrodes. Classification and coding of MS and low alloy steel electrodes. |
| **Unit 5. Welding defects**<br><br>Cracks, incomplete penetration, distortion, porosity and blowholes, lack of fusion, poor weld bead appearance, spatter, undercutting slag inclusion and overlapping. Defects in Aluminium welding |
| **Unit 6. Weldment Evaluation**<br><br>Non-destructive testing like, Visual Inspection, Leak test, Radiographic test, Magnetic Particle Inspection, Liquid Penetrant Test & Ultrasonic test. |
| **Unit 7 Welding Procedure, specifications & welders Performance qualification**<br><br>Preheat treatment and post heat treatments of welds. Welding procedure Specification (WPS) and welder's performance Qualification (WPQ). Destructive tests like Bend test, Tensile test, Impact test & Hardness test. |
| **Unit 8 Welding positions, weld joints & symbol used in shipbuilding welding**<br><br>Different welding positions, types of welds, welding symbols, different types of weld joint. Tack welding |
| **Unit 9 Special applications of welding & metal cutting processes**<br><br>Spot welding, use of bimetallic strips, single sided welding and under water welding. Oxyacetylene cutting, Plasma cutting, Arc Cutting. |

## 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | Introduction to welding | **03** | **05** |
| 2 | Safety in Welding | **03** | **05** |
| 3 | Welding Equipments & welding Processes | **10** | **15** |
| 4 | Welding electrodes and consumables | **04** | **06** |
| 5 | Welding defects | **04** | **06** |
| 6 | Weldment Evaluation | **06** | **10** |
| 7 | Welding Procedure, specifications & welders Performance qualification | **06** | **10** |
| 8 | Welding positions, weld joints &symbol used in shipbuilding welding | **08** | **10** |
| 9 | Special applications of welding & metal cutting processes | **04** | **08** |
| | | **48** | **75** |

## 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of the competency –Preparing the weld joints by MMAW process & exposure to related process

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | Introduction to welding equipment and safety |
| 2 | 3 | Striking of Arc |
| 3 | 3 | Stringer Beading in flat, horizontal & vertical position. |
| 4 | 3 | Fillet joint in horizontal position. |
| 5 | 3 | Square Butt joint in flat position |
| 6 | 9 | Demonstration of Gas Welding & Gas Cutting. |
| 7 | 3 | Exposure to TIG, MIG, SAW Welding processes. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | O. P. Khanna | Welding Technology | Dhanpat Rai Publication |
| 2 | Raymond Sacks | Welding Principles & Practices | Bennett & Knight Publishing Company |
| 3 | S.V. Nadkarni | Modern Arc Welding | Oxford & IBH Publication Co. Pvt. Ltd. |
| 4 | American Welding Society (AWS) | Welding Handbook | The Macmillan press Ltd. |
| 5 | J. A. Oates | Welding Engineers Handbook | D.B. Taraporevala Sons & Co. Pvt. Ltd. |

## (SH404) INTRODUCTION TO THERMODYNAMICS

### 1. RATIONALE:-

A general survey carried out to determine the competencies required by a diploma in Shipbuilding Engineering student revealed that the student should have an elementary knowledge of Thermodynamics. The knowledge that he acquires in this subject is essential to a student of Marine Engineering. In view of this emphasis has been laid on topics like gas processes, IC Engines, properties of steam, heat transfer and introduction to refrigeration. This subject thus provides the required cognitive skills to the student to take further courses in Marine Engineering.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH 404** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| INTRODUCTION TO THERMODYNAMICS | 3 | 1 | 1 | 5 | 75 | 25 | 25 | - | **125** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency – To understand the gas processes, IC Engines, properties of steam, heat transfer and introduction to refrigeration.

## *4.* COURSE CONTENTS

**Unit 1. Basic concepts of thermodynamics**

- Introduction, working substance or medium, system, state and properties of a substance process and cycle. System of units, units of pressure, units of volume, units of temperature, units of work & power, units of energy. Law of thermodynamics, Zeroth law of thermodynamics, first law of thermodynamics, second law of thermodynamics. Specific heat, perfect gas laws, characteristic equation for a perfect gas.

**Unit 2: Gas processes**

- Thermodynamic processes of gases, constant volume process, constant pressure process, constant temperature process, adiabatic process, reversible adiabatic (Isotropic) process, polytropic process, throttling process. Processes on P-V diagram and T-$\phi$ diagram. Calculations of work done and heat transferred.

**Unit 3: Internal Combustion Engines**

- Introduction to air standard cycles – Otto cycle, Diesel cycle, Dual cycle.
- Introduction: Classification of IC engines, IC engine terms –stroke, bore, swept volume, compression ratio, volumetric efficiency, and cubic capacity(Elementary problems)
- Functions of various engine systems of diesel engine, working of two and four stroke diesel engine, comparison of two stroke and four stroke diesel Engine.
- Indicated power and brake power calculation, mechanical efficiency and Brake thermal efficiency calculation for single acting engines

**Unit 4. Properties of steam**

Introduction. Conservation of form, phase diagram, effect of pressure on boiling point of water, temperature pressure curves for steam, saturated steam, dry saturated steam, superheated steam, dryness fraction of saturated steam, use of steam tables, sensible heat, latent heat of vaporization. Elementary problems to determine the properties of steam. Application of steam on ships.

**Unit 5. Elements of Heat transfer**

Basic concepts of heat transfer, heat transfer by conduction, convection and radiation, Fourier law of heat, introduction to heat exchangers (only elementary details), parallel flow heat exchanger, counter flow heat exchanger.

**Unit 6. Refrigeration cycles**

- Reversed heat engine cycle, vapour compression refrigeration cycle, introduction to components and their functions,
- Terms in refrigeration-TR, Wet Compression, dry compression, refrigerating effect, COP, Superheating, and Subcooling.
- Representation on P-H and T-S chart, Calculations for COP and capacity (for simple vapour compression cycle without superheating and subcooling).
- Refrigerants ,application of refrigeration on ships and harmful effects of refrigerants on environment.

## 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | BASIC CONCEPTS OF THERMODYNAMICS | **08** | **12** |
| 2 | GAS PROCESSES | **08** | **12** |
| 3 | INTERNAL COMBUSTION ENGINES | **12** | **18** |
| 4 | PROPERTIES OF STEAM | **08** | **12** |
| 5 | ELEMENTS OF HEAT TRANSFER | **04** | **06** |
| 6 | REFRIGERATION CYCLES | **08** | **15** |
| | | **48** | **75** |

## 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of the competency –To identify different engine components, refrigeration component, heat transfer equipments, study of steam table, steam calorimeter.

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 3 | Study of different parts of IC engines |
| 2 | 3 | Calculation of indicated power, brake power And mechanical efficiency. |
| 3 | 4 | Study of steam calorimeter. |
| 4 | 5 | Study on heat transfer |
| 5 | 6 | Determination of C.O.P of vapour compression refrigeration system. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | S-G Patel and Karamchandani | Elements of heat engines Vol. I | Acharya Publication |
| 2 | P.L Ballaney | Thermal Engineering | Khanna Publication |
| 3 | P.K. Nagg | Engineering Thermodynamics | Tata McGraw Hill |
| 4 | Domkundwar | Heat and Mass transfer | Dhanpat Rai Publication |
| 5 | C. P. Arora | Refrigeration and Air-conditioning | Tata McGraw Hill |

## (SH405) SHIP CONSTRUCTION TECHNOLOGY

### 1. RATIONALE:-

It is essential that engineers involved in shipbuilding is able to manage the jobs during construction of a ship. He should be acquainted with all practical technical know-how of fabrication and alignment of various ship structures. The course content has been so designed that the students acquire knowledge and skill in execution of projects pertaining to structures in shipbuilding. Having studied this subject, students should be able to: Know nomenclature used to describe ship structural components.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH 405** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| SHIP CONSTRUCTION TECHNOLOGY | 3 | 0 | 2 | 5 | 75 | 25 | 25 | - | **125** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency – To understand the constructional aspects of ship structure.

## *4.* COURSE CONTENTS

| |
|---|
| **Unit 1: Ship structure**<br><br>General arrangement of structure of Bulk Carriers and Tankers. Midship sections of Bulk Carriers and Tankers. Double hull structure. |
| **Unit 2: Bottom Structure**<br><br>Bottom structure – Single bottom construction and double bottom construction – keels, types of floor, girders, bottom frames – transverse and longitudinal framing. Bilge keel |
| **Unit 3: Side Shell and Deck structure**<br><br>Side shell and decks – transverse and longitudinal framing, side transverses ,deck transverse/ beams, longitudinals, stringers, deck girders. Cargo hatches |
| **Unit 4: Structure of Bulkheads**<br><br>Bulkheads – Transverse and longitudinal, Corrugated and Ordinary Stiffened Bulkheads. |
| **Unit 5: Fore end ,Aft end and Engine room structure**<br><br>• Fore end-stem-Normal raked bow , bulbous bow, stembar, panting stringers, breast hooks, deep floors, hawse pipe, bow thruster tunnel, chain locker.<br>• Aft end- cruiser stern, transom stern, shape of propeller aperture, stern frames for different types of rudders, types of rudders, steering gear flat, rudder trunk, stern tube, A-bracket and Bossing.<br>• Engine room structure- engine girders, platform decks |
| **Unit 6 Deckhouse and superstructure construction**<br><br>Deckhouse and superstructure construction including engine casing. |
| **Unit 7: Closing Appliances**<br><br>Closing appliances-doors, windows, scuttles, hatches, skylights, ventilator covers. |
| **Unit 8: Deck machinery arrangement & layout**<br><br>Mooring and rigging arrangement, masts, life saving appliance, access ladders, gangways. |

## 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | Ship structure | **04** | **06** |
| 2 | Bottom Structure | **06** | **09** |
| 3 | Side Shell and Deck structure | **05** | **09** |
| 4 | Structure of Bulkheads | **08** | **12** |
| 5 | Fore end ,Aft end and Engine room structure | **12** | **18** |
| 6 | Deckhouse and superstructure construction | **04** | **06** |
| 7 | Closing Appliances | **05** | **09** |
| 8 | Deck machinery arrangement & layout | **04** | **06** |
| | | **48** | **75** |

## 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of competency for –Preparing different sketches and description of ship structure

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | Sketching & labeling of Midship section of Bulk Carrier and tanker. Transverse & longitudinal framing |
| 2 | 1 | Sketching & labeling of longitudinal section and deck plan of Bulk carrier. |
| 3 | 2 | Sketching & labeling of Double bottom, types of floors & their application. |
| 4 | 2 | Sketching & labeling of Single bottom construction details. |
| 5 | 3 | Sketching & labeling of Bulkheads-Corrugated, ordinary, transverse, longitudinal, stiffening arrangement. |
| 6 | 5 | Sketching & labeling of Fore-peak structure, stem bar, panting stringers, breast hooks and deep floors |
| 7 | 5 | Sketching & labeling of Rudders – single plate , double plated, underhung rudder ,rudder with heel pintle, rudder with rudder horn. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | D. A. Taylor | Merchant Ship Construction | Buttersworth Hienemann |
| 2 | R. Taggart | Ship Design & Construction | SNAME |
| 3 | D.J.Eyres. | Ship Construction | Elsevier |
| 4 | Pursey | Merchant ship construction | Brown, son & Ferguson |
| 5 | Reed's series | Ship Construction for Marine students | Thomas Reed |
| 6 | Hogg. | Ship Construction for Marine Engineering | The Institute of Marine Enginners, London |

## (ME401) STRENGTH OF MATERIALS

### 1. RATIONALE:

Machine parts are subjected to various types of loads resulting in development of stresses and strains. If, these stresses and strains are allowed to develop beyond the safe limit, the concerned part may fail. As a technician, it becomes very essential to understand the effects of loads on any part All these factors are focussing the attention of the technicians and engineers for need based designs by studying the effects of loads, stresses and strains in the parts and find necessary solutions. This subject deals with the effect of various forces under static situation & the resulting stresses in different components.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **ME 401** | **L** | **T** | **P** | **C** | **TH** | **TM** | **PR/OR** | **TW** | **150** |
| Strength of Material | 3 | 1 | 2 | 6 | 75 | 25 | - | 50 | |

*Minimum passing % : Theory 40% and Practical 40%* *Duration of Theory Paper: 3 Hrs.*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE:

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – ***Apply the laws of Statics to estimate different types of stresses & strains under different loading situations.***

## 4. DETAILED COURSE CONTENT

| | |
|---|---|
| **Unit 1** | **Simple stress & strain**<br>▪ Definition of stress & strain.<br>▪ Tensile & compressive stress & Strain, elastic limit, Hooke's law, Young's Modulus, Stress- Strain curve for ductile & brittle material, Significant points on stress-strain curve.<br>▪ Thermal stresses in homogeneous sections<br>▪ Shear load, shear stress & strain, modulus of Rigidity.<br>▪ Lateral strain & Poisson's ratio.<br>▪ Volumetric strain, Bulk modulus. Relation between modules of elasticity, bulk Modulus & modulus of rigidity. |
| **Unit 2** | **Principal stress & strain**<br>• Different states of stresses,<br>• Normal & Tangential stress on oblique planes, resultant stress.<br>• Principal stresses & principal planes (no derivation)<br>• Analytical method to calculate principal stresses. |
| **Unit 3** | **Shear Force & Bending Moment**<br>• Types of beams & supports.<br>• Concepts of shear force & bending moment, sign conventions. Shear force & bending moment diagram for simple cantilever & simply supported beams subjected to point & uniformly distributed load only. |
| **Unit 4** | **Moment of Inertia**<br>• Centroid and Center of Gravity<br>• Definition of M.I., radius of gyration,<br>• Perpendicular & Parallel axis theorem.<br>• M.I. of Rectangular, Circular, Semi-circular, Triangular, Hollow rectangular, symmetrical I-section, Channel section, Tee & Angle section. |
| **Unit 6** | **Torsion**<br>• Concept of pure torsion, moment of resistance,<br>• Torsion equation, assumptions in theory of pure torsion,<br>• Strength of circular solid and hollow shaft in pure torsion.<br>• Shear stress distribution<br>• Polar modulus, Power transmitted by shaft. |

**Note : Question paper will not carry questions on derivation.**

## 5. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

| Unit No. | Unit | Teaching Hours / Semester | Theory Marks Distribution for End Semester Exam | | | |
|---|---|---|---|---|---|---|
| | | | R | U | A | Total |
| 1 | **Simple stress & strain** | 10 | 4 | 4 | 7 | 15 |
| 2 | Principle stress & strain | 6 | 3 | 3 | 6 | 8 |
| 3 | Shear Force & Bending Moment | 8 | 2 | 2 | 10 | 14 |
| 4 | Moment of Inertia | 8 | 2 | 2 | 6 | 12 |
| 5 | Theory of Simple Bending | 8 | 2 | 4 | 8 | 14 |
| 6 | Torsion | 8 | 2 | 2 | 6 | 12 |
| | Total | **48** | | | | **75** |

***Legends:*** *R = Remembrance; U = Understanding; A = Application and above levels*

## 6. SUGGESTED LIST OF EXPERIMENTS

| Sr. No. | Unit No. | Title of Practical |
|---|---|---|
| 1. | 1 | Demonstration of working of Universal testing machine (UTM) |
| 2. | **1** | Tensile test on mild steel, brass and aluminum using UTM. |
| 3. | **1** | Compression test on wood using UTM |
| 4. | 1 | Single shear & double shear test on mild steel bars using UTM. |
| 5. | 1 | Hardness tests on metals. (Brinell, Rockwell test, Vickers) |
| 6. | 3 | Izod impact test on M.S., Aluminum, Brass |
| 7. | 3 | Charpy impact test on M.S., Aluminum, Brass |
| 8. | 6 | Flexural test on mild steel/ wood specimen |
| 9. | 7 | Torsion test on mild steel specimen |

## 7. SUGGESTED LEARNING RESOURCES

| S.No. | Author | Title | ,Publisher |
|---|---|---|---|
| 1. | R.S. Khurmi | Strength of materials | S. Chand Publisher, New Delhi |
| 2 | S. Ramamurutham | Strength of materials | Dhanpat Rai & sons |
| 3 | I.B. Prasad | Strength of materials | I.B. Prasad |
| 4 | Bhavikatti | Strength of materials | |
| 5 | B.C. Punamia | Strength of materials | |
| 6 | Sadhu Singh | Strength of materials | |
| 7 | Timoshenko & Gere | Mechanics of Materials | CBS Publisher & Distributors, New Delhi |
| 8 | B.P. Sharma. | Laboratory Experiments in Strength of materials | |
| 9 | Surya Narayan | Testing of Metallic materials by | |
| 8. | | Strength of Materials | Schaum Series |
| 9. | F.L.Singer | Strength of Materials | London Harper & row |

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**SEMESTER V**

| Course code | Name of Course | EXAMINATION SCHEME | | | | Total |
|---|---|---|---|---|---|---|
| | | TW | | PR/OR | | |
| | | Daily Diary | Progressive Assessment | Training Report | Report Assessment & Seminar/ Viva | |
| SH501 | Inplant Training Phase I | 50 | 50 | 50 | 50 | Grade |

**SEMESTER VI**

| Sr. No. | Course Code | Name Of The Course | Teaching Scheme | | | | Exam Scheme | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Marks | | Pr. Marks | | |
| | | | L | T | P | C | TH | TM | PR/OR | TW | |
| 1 | SH601 | Ship Resistance & Propulsion | 4 | 0 | 0 | 4 | 75 | 25 | 0 | 25 | 125 |
| 2 | SH602 | Ship Repair Engineering | 4 | 0 | 2 | 6 | 75 | 25 | 25 | 25 | 150 |
| 3 | SH603 | Ship Drawing & Calculation | 1 | 0 | 6 | 7 | 75 | 25 | 25 | 25 | 150 |
| 4 | CS501 | Entrepreneurship Development | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 50 | 50 |
| 5 | CS601 | Industrial Organisation Management | 3 | 0 | 0 | 3 | 75 | 25 | 0 | 0 | 100 |
| 6 | | ELECTIVE I | 4 | 0 | 2 | 6 | 75 | 25 | 25 | 25 | 150 |
| **TOTAL** | | | **16** | **0** | **12** | **28** | **375** | **125** | **75** | **150** | **725** |

ELECTIVE I

SH611 MARINE REGULATIONS

FE604 QUALITY CONTROL & INSPECTION

SH612 MATERIAL HANDLING AND SAFETY ENGINEERING

ME601 MACHINE DESIGN PRACTICE

FOR INDUSTRIAL TRAINING OF V$^{TH}$ & VIII$^{TH}$ SEMESTER:

1. Grades will be awarded based on marks scored as follows:
   a. 80% and above Marks – Grade 'A'
   b. 60% to 79% Marks – Grade 'B'
   c. 40% to 59% Marks – Grade 'C'
   d. Marks below 40% - Grade 'D'

2. TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade 'C' for passing.

3. Student with Grade D under the Head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D under the head PR/OR, shall be declared Failed/ATKT.

# SEMESTER V

## (SH501) INPLANT TRAINING PHASE I

### 1. RATIONALE:-

The objective of the training is to correlate theory and practice. Through training the students will be able to get hands on experience in the various job activities associated with ship construction and obtain practical knowledge and experience in the installation, operation and maintenance of marine machinery. The students will be exposed to industrial environment, obtain experience in working under factory discipline, associate with workers and understand their psychology and work habits, and get familiarised with various materials, structural members of ship, processes and shop floor practices.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course code | Name of Course | EXAMINATION SCHEME | | | | Total |
|---|---|---|---|---|---|---|
| | | TW | | PR/OR | | |
| | | Daily Dairy | Progressive Assessment | Training Report | Report Assessment & Seminar/ Viva | |
| SH501 | Inplant Training Phase I | 50 | 50 | 50 | 50 | Grade |

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The training imparted through this course should be such that the theory learned during first 4 semesters of Shipbuilding Engineering can be linked with the Industrial practices and the outcome of the inplant training should aid in understanding the subjects of further semesters.

## *4.* COURSE CONTENTS

| |
|---|
| **Unit 1 Ship Structure**<br>The basic structural members of Ship, and their functions |
| **Unit 2. Lofting**<br>Preparation of offset, fairing of full scale lines, preparation of templates. |
| **Unit 3 Steel preparation & Fabrication**<br>Shot blasting, priming, making, cutting using pug cutting machine, edge preparation, and use of grinding wheel. Plate bending. CNC cutting.<br>Welding, arc welding, gas welding, erection of sub assembly, structural components, preparation of skids, alignment of sub-assemblies. Block Fabrication. |
| **Unit 4 Out-fitting**<br>Pipe-fabrication, preparation of templates, system assembly, pressure testing, commissioning of system. Rudder installation, propeller mounting, chock fasting, shaft alignment. Machinery installation, fabrication of machinery seating, machinery alignment, testing and commissioning. |
| **Unit 5 Launching**<br>Side Launching, end launching, crane launching, balloon launching and dock launching. |
| **Unit 6 Material handling**<br>Types of Cranes, trolleys, Pallets, winches and other accessories. |

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**Daily dairy:** The students are required to maintain a daily diary as a day to day record of their attendance at the factory, indicating clearly the activities/jobs performed by them during the day. End of the training a questionnaire provided by department needs to be filled by students.

**Training Report:** Doing the daily diary, the students will prepare a report detailing all the jobs activities performed at the yard and in full detail the specific projects undertaken by them. The report will also cover the layout of the yard, facilities and infrastructure, types of ships under construction, etc. The report is to be in typed format complete with illustrations and drawings.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

# SEMESTER VI

## (SH601) SHIP RESISTANCE AND PROPULSION

### 1. RATIONALE:-

The course contents is framed to impart knowledge to students to understand the relevance of resistance, estimate ship resistance, select main propulsion plant based on resistance calculations, known various aspects of resistance and the dependence on hull-form, know different types of propellers and their application, familiarize with propeller data series.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH601** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| SHIP RESISTANCE AND PROPULSION | 4 | - | - | 4 | 75 | 25 | 25 | - | **125** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency -To understand types of resistances encountered by ship, propulsion and types of propulsion devices

## *4.* COURSE CONTENTS

| |
|---|
| **Unit 1 Resistance**<br>Components of resistance: Frictional resistance, wave making resistance, Eddy resistance, viscous pressure drag, air resistance, wind resistance, wave breaking resistance, residuary resistance. Dimensional analysis. Froude's No., Reynold's No., Froude's law off similarity. Model testing – Geometric, kinematic and dynamic similarity. Procedure for model testing. Estimation of frictional resistance. Model ship correlation, calculation of effective power. Shallow water effect. Estimation of resistance from Guldhammer's and Harvald's diagram. |
| **Unit 2 . Screw propellers**<br>Geometry of propeller- Pitch rake, skew, diameter. Interaction between hull and propeller-wake, slip, thrust deduction. Open water tests and Self-propulsion test. Propeller materials. |
| **Unit 3 Special Types of Propellers**<br>Special types of propellers and their applications. Ducted propellers, vertical axis propellers, controllable pitch propellers, Tandem and Contra rotating propellers, super cavitating propellers. |
| Unit 4 **Estimation of bhp of main engine**<br>Effective power, Thrust Power, Delivered power, Shaft Power, Brake horse Power, IHP, MCR Rating. Estimation of BHP of Main Engine. |
| **Unit 5 Stern gear**<br>Stern tube, sealing arrangements, types of sterntubes, A-brackets. |
| **Unit 6 Gears box**<br>Reduction and reversing gears. |
| **Unit 7 Rudders**<br>Types of rudders. Angle of heel due force exerted on rudder. Angle of heel while turning. Rudder stock diameter. Maneuvering trials. |

## 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Resistance | 21 | 24 |
| 2 | Screw propellers | 13 | 15 |
| 3 | Types of Propellers | 08 | 09 |
| 4 | Estimation of bhp of main engine | 04 | 06 |
| 5 | Stern gear | 05 | 06 |
| 6 | Gears box | 05 | 06 |
| 7 | Rudders | 08 | 09 |

| Unit No. | Topic | Teaching Hours/ Semester | Marks |
|---|---|---|---|
| | | 64 | 75 |

## 6. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | Edward V. Lewis | Principles of Naval Architecture | SNAME |
| 2 | A. A. Harvald | Resistance and Propulsion of Ships | Wiley Interscience Publication |
| 3 | Eric Tupper | Introduction to Naval Architecture | Butterworth Heinmann |
| 4 | Baxter, B. | Naval Architecture Examples and Theory | Charles Griffin & Co |

## (SH602) SHIP REPAIR ENGINEERING

### 1. RATIONALE:-

The course content is designed to meet the needs of the present day ship repair yard. The engineer is trained: To know how vessels are berthed and docked when brought for repair work. To identify the areas needing repairs. To acquaint themselves with various aspects of survey carried out when vessel is at the berth and in the dry dock. To know the regular maintenance aspects of a vessel and how it is maintained under class.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| SH602 | L | T | P | C | TH | TM | TW | PR/OR | |
| Ship Repair Engineering | 4 | - | 2 | 6 | 75 | 25 | 25 | 25 | 150 |

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Understanding the concept of Planned Maintenance of hull and machinery; requirements and procedure of docking vessels; Role of classification and hull and machinery Surveys; Ship repair facilities and their functions; hull defects and repair methods; Appreciation of General requirements for maintenance and repairs of Marine engines, Auxiliary machinery and Safety Equipment on board ships.

Awareness of safety requirements during ship repairs. Acquaintance with commercial aspects of ship repairs.

(Details, maintenance, methods of repairs of machinery and equipments are not -included in the competency to be achieved by this course.)

4. **COURSE CONTENTS**

| |
|---|
| **Unit 1. Ship repair facilities**<br>Docking systems, description, comparison, Docking plan details and significance, services to ships in dock. Supporting repair shops, nature of jobs involved in ship repairs. Procedure for docking / undocking. |
| **Unit 2. Hull repairs (Above water & Underwater areas)**<br>Hull surveys, types of defects, methods of gauging, limits of acceptance, areas of maximum wastage, areas susceptible to erosion, buckling, dents, cracks, etc. Preparation for hull repair, cleaning, gas freeing, ventilation, access, staging, additional supports, removal of blocks. Procedure for repairs, sequence of gas cutting, fitting and welding. Fitting doublers and inserts. Marking, use templates for odd size and shape. Temporary repairs, cement box. Testing of repaired areas and compartment. |
| **Unit 3. Repairs of underwater equipment**<br>Withdrawal of propeller and tail end shaft. Propeller drop measurement. Inspection and repairs of propeller, shaft, seals, stern tube and A-bracket bearings, Static balancing of propeller. Rudder drop and bearing clearance measurement. Rudders removal, repairs and refitting. Repairs of Rudder stock, pintles, bushes. Trials in dry dock. Ranging anchors and cables - Inspection, gauging, acceptable levels, rearrangement. Repair of chain links, shackles and anchors. Sea chest and connections. Underwater fittings. Anodes cathodic protection. Dry docking survey. |
| **Unit 4. Repair of hull fittings and equipments**<br>Load line survey and repairs. Hatch covers, watertight doors, tank manholes, scuttles, air pipes, freeing ports, railing, bulwark. Testing water tightness of closing appliances. Masts, ventilators, hawse pipe, scuppers, derricks, cargo gear inspection, repairs and testing. Deck pipe line repairs. Use of blanks and spectacle flanges. Making template and Fabrication of pipe. Expansion joints, clamps, pipe testing. Insulation of pipes. |
| **Unit 5. Hull protection and insulation**<br>Method of descaling. H.P. water wash, sand blasting, chipping Standards of surface finish. Painting scheme for underwater hull, shipside, deck, cargo hold, ballast tank, F.W. tank, and superstructure. Deck sheating, flooring deck composition, bulkhead insulation, and paneling. |
| **Unit 6. Repair and maintenance of main engines and auxiliaries.**<br>Maintenance schedule. Understanding the functions of main engines and auxiliary machinery & equipments. Appreciation of engineering requirements for general maintenance and repairs of the Main Engine, |

| |
|---|
| Auxiliaries such as Generators, Boilers and Boiler mountings, steam condenser, steam heater, fresh water generator, air compressor, centrifugal pump, reciprocating pump, gear pump, heat exchangers. |
| **Unit 7. Maintenance of safety equipments**<br>Safety equipment surveys. Annual inspection procedure, boat and fire drill. Repairs of fibre glass boats, inflatable life rafts and life buoys. Renewal of wire ropes and cordage's. Testing and recharging fire extinguishers of various types. Weightment and Servicing $CO_2$ bottles. Testing $CO_2$ system by compressed air. Maintenance and testing of fire mains, hydrants, hoses and nozzles. |
| **Unit 8. Office procedure and costing**<br>Defect list, quotation, job order and work done certificate. Records of repairs and maintenance, shell expansion and structural plans. History sheet for machinery maintenance. Gauging, calibration, tests and trial reports. Costing, cost components. Estimation of material, manpower and time requirement. Direct and indirect cost. Subcontract. Bill preparation. |
| **Unit 9. Safe Working Practices in ship repairs.** |

## 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | Ship repair facilities | 08 | 09 |
| 2 | Hull repairs (Above water & Underwater | 08 | 09 |
| 3 | Repairs of underwater equipment | 08 | 09 |
| 4 | Repair of hull fittings and equipments | 08 | 09 |
| 5 | Hull protection and insulation | 04 | 05 |
| 6 | Repairs and maintenance of main engines & | 16 | 12 |
| 7 | Maintenance of safety equipments | 04 | 10 |
| 8 | Office procedure and costing | 06 | 06 |
| 9 | Safe working practices in ship repairs | 02 | 06 |
| | | **64** | **75** |

## 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of the competency.

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | Sketching layout of a ship repair yard and labeling the various facilities. |
| 2 | 1 | Sketching and describing Docking Plan of a ship showing necessary details. |
| 3 | 2 | Sketching and describing hull repairs details- bottom shell/ side shell; plate/ section renewal and welding. |
| 4 | 3 | Propeller shaft inspection, withdrawal, reconditioning and refitting – listing out chronological events and methods. |
| 5 | 3 | Anchor and cables inspection and repairs – Equipment number, chain size, sketching kenter shackle. |
| 6 | 4 | Guidelines to repair of pipelines – typical example of piping renewal, standards for pipes and flanges, nominal diameter, etc. |
| 7 | 5 | Painting scheme for a ship – describing a painting scheme for different areas of ship with DFT. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | D. Benkovsky | Ship Repair Technology | MIR Publications |
| 2 | S.G.Khare | Hull Repairs | Society for Industrial & Technical Education in Goa. |

## (SH603) SHIP DRAWING & CALCULATIONS

### 1. RATIONALE:-

The course content is designed to enable the students to perform intact stability calculation, and floodable length calculations. It also enables students to understand the mid-ship section, design process, and determine scantlings from classification society rules. The student will be also able to perform longitudinal strength calculation.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH603** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| SHIP DRAWING & CALCULATIONS | 1 | - | 6 | 7 | 75 | 25 | 25 | 25 | **150** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency –to carry out calculations & drawings involved in design process of ships.

## *4.* COURSE CONTENTS

| |
|---|
| **Unit 1 Cross curves of stability**<br>Calculation and drawing cross curves of stability, calculation of initial meta-centric height, dynamical stability. |
| **Unit 2 Mid ship section calculations & drawing**<br>Calculation of hull girder section modules, check on mid- ship section modulus, stresses induced on deck and keel. Bulkhead drawing. |
| **Unit 3. Flooding calculations**<br>Calculation on subdivision, and floodable length, drawing of floodable length curves. |
| **Unit 4 Strength curves**<br>Longitudinal strength calculation, cargo and hull weight distribution, load curve, shear Force and bending moment diagrams. |

### 5. SPECIFICATION TABLE WITH HOURS & MARKS (Termwork )

| Unit No. | Topic | Practical Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Cross curves of stability | **30** | **24** |
| 2 | Mid ship section drawing | **30** | **21** |
| 3 | Flooding calculations | **18** | **15** |
| 4 | Strength curves | **18** | **15** |
| | | **96** | **75** |

### 6. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | Rawson, K.J. & Tupper. | Basic Ship Theory Vol.1 & 2 | Longman |
| 2 | Edward V. Lewis | Principles of Naval Architecture | SNAME |
| 3 | D.J. Eyres. | Ship Construction | Butterworth Heinemann |
| 4 | Eric Tupper | Introduction to Naval Architecture | Butterworth Heinemann |
| 5 | Baxter, B. | Naval Architecture Examples and Theory | Charles Griffin & Co |
| 6 | Taggart | Ship Design and Construction | SNAME |
| 7 | NA | Rules for Building and Classing Steel vessels | American Bureau of Shipping |
| 8 | NA | Classification of Ship-Rules and Regulation | Lloyd's Register of Shipping. |

# (CS501) ENTREPRENEURSHIP DEVELOPMENT

## 1. RATIONALE

The course on Entrepreneurship Development focuses on creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects related to setting up of enterprise. This can be helpful in motivating technical students to start their own small-scale business/enterprise.

## 2. TEACHING AND EXAMINATION SCHEME

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| | L | T | P | C | - | - | PR/OR | TW | |
| CS501 Entrepreneurship Development | - | - | 2 | 2 | - | - | - | 50 | 50 |

*Minimum passing % Practical 40%*

## 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – ***Prepare a detailed project report for an identified product/service.***

## 4. DETAILED COURSE CONTENT

**Unit 1:Introduction** (7 Hours, 12Marks)

Meaning of entrepreneurship, need in the present scenario, definition of an entrepreneurship, qualities of an entrepreneur, functions of an entrepreneur, risks and rewards of entrepreneurship.

Definition of Micro, Small And Medium Enterprises ( MSME).Classification of Micro, Small And Medium Enterprises ( MSME). Types of Enterprises - manufacturing, service and franchisee.

**Unit 2:Forms of Business Organisation** ( 2 Hours, 9Marks)

Main features of Sole Proprietorship, Partnership, Private Limited Company, Public Limited Company, Co-operative Society.

**Unit 3:Entrepreneurial Support System** (6 Hours, 9 Marks)

Central Government Agencies: Functions of Small Industries Development Bank of India(SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC), Micro, Small And Medium Enterprises -Development

Institute ( MSME- DI), Technology Business Incubator (TBI), Khadi & Village Industries Commission (KVIC).

State Government Agencies: Functions of District Industries Centre(DIC), Goa Industries Development Corporation (GIDC), Economic Development Corporation (EDC), Financial Institutions-Banks, Goa Handicrafts and Rural Small Scale Industries Development Corporation (GHRSSIDC), Rural Development Agency (RDA), Khadi and Village Industries Board (KVIB).

**Unit 4: Business Opportunity Identification** (7 Hours, 6 Marks)

Evaluation of business opportunity:- selection of industry, initial prospects study, product marketing concept, decision to proceed, feasibility study, project evaluation.

**Unit 5: Market Research** (6 Hours, 12 Marks)

Definition of demand, factors affecting demand, law of demand,demand curves

Definition of supply, factors affecting supply,law of supply, supply curves.

Preparation of questionnaire. Data collection for setting up a small enterprise.

**Unit 6: Legal Aspects** (4 Hours, 9 Marks)

Procedure of registration of Micro, Small And Medium Enterprise (MSME), meaning and registration of Value Added Tax(VAT), Service Tax, PAN. Slabs of Income tax.

**Unit 7: Project Report** (16 Hours, 18 Marks)

Need for project report, importance of Project report,

scope of project report:Economic aspects, technical aspects,financial aspects, managerial aspects, production aspects.

List the contents of a project report.

Proforma of a project report which includes:-Introduction,scheme, profitability and projections, infrastructure, break- even point, names and addresses of suppliers, remarks.

Project Profile.

Project appraisal criteria:- technical feasibility, financial feasibility, economic viability, commercial viability, managerial competency, political and labour considerations.

**5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

| Unit No. | Topic | Teaching Hours/ Semester | MARKS |
|---|---|---|---|
| 1. | Introduction | 7 | 12 |
| 2. | Forms of Business Organisation | 2 | 9 |
| 3. | Entrepreneurial Support System | 6 | 9 |
| 4. | Business Opportunity Identification | 7 | 6 |
| 5. | Market Research | 6 | 12 |
| 6. | Legal Aspects | 4 | 9 |
| 7. | Project Report | 16 | 18 |
| TOTAL | | 48 | 75 |

**6. MANDATORY ASSIGNMENTS**

1. Preparation of a Case Study on leading entrepreneurs of Goa. (To be taken while conducting Unit 1)
2. Preparation of a Case Study on leading entrepreneurs of India. (To be taken while conducting Unit 1) Unit 1)
3. Filling of template of "Business Model Canvas"
4. Prepartion of Project Profile.
5. Preparation of Project Report.

**7. SUGGESTED ACTIVITIES:**

1. Visits to related departments (DIC,Banks,Tecnology Business Incubators, MSME-DI, NSIC, KVIC, KVIB).
2. Study visits to industries.
3. Organise entrepreneurship related event / activities.
4. Organise lectures/seminars with successful entrepreneurs.
5. Organise brainstorming sessions on ideation.
6. Establish an Entrepreneurship Development Cell.

**8. SUGGESTED LEARNING RESOURCES**

| S.No. | Author | Title of Books | Year of Publication |
|---|---|---|---|
| 1 | *Sharad jawadekar, shobha dodlani,* | *Business entrepreneurship* | *Suvichar prakashan mandal pune,* |
| 2 | *S.S. Khanna* | *Entrepreneurship development* | *S. Chand & Co. Ltd, New Delhi,* |
| 3 | *Vasant Desai* | *Management of small Scale Industry in India* | *Himalaya Publishing House* |
| 4 | *Dilip Sarwate* | *Entrepreneurial development Concepts and practices* | *Everest Publication House, Pune* |
| 5 | *CB Gupta and P Srinivasan* | *Entrepreneurship Development* | *S. Chand and Sons, New Delhi* |
| 6 | *PM Bhandari* | *Handbook of Small Scale Industry* | |

## (CS601) INDUSTRIAL ORGANISATION AND MANAGEMENT

### 1. RATIONALE

When a diploma pass out will start working in the wok place in any office or shop floor, he /she has to perform work or get work done from subordinates on day to day basis as well as for ongoing week or month. This performance has to be very efficient and effective in order to achieve the set goals. The work performance demands proper manaegement of all kinds of resources (money, material, men, machines, methods, time) for achievement of goals. This management has a science part as techniques of planning, organising, directing & controling. It has an art part, how well these techniques are applied to get the desired results. The student should have a good knowledge of art & science of management, so that he is able to motivate himself & others to work.

### 2. TEACHING AND EXAMINATION SCHEME

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| CS601 Industrial Organisation and Management | L | T | P | C | TH | TM | PR/OR | TW | 100 |
| | 3 | - | - | 3 | 75 | 25 | - | - | |

*Minimum passing % : Theory 40% and Practical 40%  Duration of Theory Paper: 3 Hrs.*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency **– ' *Use principles of industrial management in production, operation & maintenance of mechanical components & systems***

### 4. DETAILED COURSE CONTENT

*Unit 1* Business Organisation

**Types of business organizations:** Individual Proprietorship Organisation, partnership organization, Joint Stock Companies : Private Ltd and Public Ltd , Co-operative societies, Public sector Organisation

**Structure of business organization:** Line Organisation, Functional Organisation , Line and staff Organisation, Project organization

*Unit 2* Business Management

**Functions of management:** Concept of management and administration, management as an art and science, evolution and growth of scientific management- contribution of F.W Taylor, management functions such as forecasting, planning, organizing, directing, communicating, controlling, co-ordinating, motivating, guiding, counseling and decision- making.

**Functions in Industry**: Procuring, store- keeping, inventory control, material handling, manufacturing or production, supervision, quality assurance, packing and forwarding, marketing- sales promotion, research and development, supervisory skills. Introduction to ISO.

*Unit 3* Financial Analysis

**Finance:** Introduction, sources of finance, important financial statement such as profit and loss, balance sheet and cash flow.

**Cost Concepts:** Introduction, necessity of costing, elements of cost- direct and in direct, variable and fixed, prime cost, overhead cost, total cost, marginal costing, break- even chart analysis, angle of Incidence.

**Materials management:** Economic Order quantity, reordering system, base stock and lead time, inventory valuation , ABC Analysis

Definition of Budget and Budgetory control

**Depreciation:** Methods of calculating depreciation charges : Straight Line Method , Sinking Fund Method, Diminishing Balance Method.

**Obsolescence**- definitions and reasons.

*Unit 3* Personnel Management

**Functions of Personnel Department:** Human resource Planning, selection and recruitment, training and placement, promotion and transfer, motivation and morale of workers, welfare of employees.

**Industrial Relations:** Relations with Individual worker, relations with unions, relations with government, settlement of disputes of employees, collective bargaining, conciliation,

arbitration, grievance handling mechanism, domestic inquiry.

**Wages and Incentives:** Types of wage plans – Time rate and piece rate, characters of good wage plan, incentive – objectives and advantages, character of good incentive plan, individual and group, incentive plan, difference between incentive and wage.

**Unit 4** ***Industrial Acts and Taxes***

Introduction to Following Industrial Acts:

Industrial Disputes Act 1947/1956;

The Indian Factories Act 1948

The Workmens Compensation Act 1923;

Introduction to sales tax, Custom and excise duty , VAT.

**Unit 5** ***Project Management : Network Analysis***

(Introduction to basic concepts with simple problems)

PERT- Programme Evaluation and Review Technique: Definition, network diagrams, advantages.

CPM- Critical Path Method: Definition, finding critical Path, advantages, Comparison of PERT and CPM.

## 5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Minimum Teaching Hours per Semester | Total Marks |
|---|---|---|---|
| 1 | Business Organisation | **6** | **9** |
| 2 | Business Management | **10** | **15** |
| 3 | Financial Analysis | **13** | **21** |
| 4 | Personnel Management | **10** | **15** |
| 5 | ***Industrial Acts and Taxes*** | **4** | **6** |
| 6 | ***Project Management***<br>***Network Analysis*** | **5** | **9** |
| | *Total* | **48** | **75** |

## 6. SUGGESTED LEARNING RESOURCES

| S.No. | Author | Title of Books | Publication & Year |
|---|---|---|---|
| 1 | T R Banga , S.C. Sharma | Industrial organization & Engineering Economics | Khanna Publishers Latest |
| 2 | O.P. Khanna | Industrial engineering & management | Khanna Publishers |
| 3 | Awate, Chuna wala, Bhandarkar, Shrinivasan | Industruial Organisation & Management | Latest |
| 4 | M.C. Shukla | Bussines Organisation & management | Latest |
| 5 | M. Mahajan | Industrial Engineering & Production Management | Dhanpat Rai & co. |
| 6 | O.P. Khanna | Industrial engineering & management | Khanna Publishers |
| 5 | Satya saran Chatterji | Modern Business- Organisation & Management | Latest |

## (SH611) MARINE REGULATIONS

### 1. RATIONALE:-

Shipping and Shipbuilding are global enterprises involving many nations. Each nation has its own rules and regulations concerning shipping. A commonality of rules and regulations is required for global enterprises to function. The International Maritime Organisation (IMO) is the body that ensures commonality of rules and regulations in the marine field. The member countries of the IMO incorporate the rules and regulations framed by the IMO, in the rules and regulations of their respective countries and set up mechanisms for administering these rules. These rules relate to Safety of ships, ship's personnel and passengers, and the marine Environment. The students should understand this regulatory frame work and the essential features of these rules and regulations.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH611** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| MARINE REGULATIONS | 4 | 0 | 2 | 6 | 75 | 25 | 25 | 25 | **150** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The students should understand the need for the regulations, how these are framed and implemented. They should understand the basic

tenets of the rules and regulations, the scope of their application and the procedures for their implementation.

They should acquire the capacity to navigate through the provisions of some of the basic rules and apply these in respect to shipbuilding. Detailed provisions and calculations are not in the scope of competency.

## 4.COURSE CONTENTS

| |
|---|
| **Unit 1: Introduction to the regulatory framework for Shipbuilding and Shipping industry**<br><br>Various organizations involved and interplay of their functions with respect to shipping and shipbuilding.<br><br>Organisations, such as IMO, Administrations, IACS and Classification Societies, and their roles in the context of shipbuilding.<br><br>Basic understanding of - International maritime conventions, Protocols, Maritime safety committee (MSC) and Marine Environment Protection Committee (MEPC). Process of ratification and adoption by various Administrations.<br><br>Introduction to Indian Merchant Shipping Act and formation of Indian merchant shipping regulations.<br><br>Process of implementation of the Rules by the Administration. (DG Shipping, MMD). Flag administration and control, Port state control. |
| **Unit 2: Load Line Regulations**<br><br>Application, General provisions of the Regulations, Calculation of Freeboard, Load line Plan, Load line Certificate and Conditions of Assignment, Implementation and Surveys. |
| **Unit 3: SOLAS Regulations**<br><br>Consolidated Editions of Convention of 1974 & Protocol 1988 and subsequent Amendments, Application, General provisions and basic concepts of the Regulations. Explanatory examples of application of some of the rules in shipbuilding. |

| |
|---|
| **Unit 4: MARPOL Regulations**<br><br>Consolidated Editions, General provisions and basic concepts of the regulations. Explanatory examples of application of some of the rules in shipbuilding. |
| **Unit 5: Basic provisions of other regulations**<br><br>Ballast Water Management, Green ships, Recycling. |

**5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )**

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | Introduction to the regulatory framework for Shipbuilding and Shipping industry | **10** | **16** |
| 2 | Load Line Regulations | **9** | **12** |
| 3 | SOLAS Regulations | **15** | **24** |
| 4 | MARPOL Regulations | **10** | **15** |
| 5 | Basic provisions of other regulations | **4** | **08** |
| | | **48** | **75** |

**6. SUGGESTED LIST OF EXPERIMENTS**

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of competency for understanding Marine Regulations

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | Assignment on application of safety considerations in Structural arrangement in ships. |
| 2 | 2 | Assignment on load line survey. |
| 3 | 3 | Assignment on fire protection of Ships- prevention, detection, and extinction. |
| 4 | 4 | Assignment on process of disposal of oily waste/oily water from a ship. |
| 5 | 5 | Assignment on development of technology to ensure compliance with ballast water requirements. |
| 6 | 5 | Assignment on concept of recycling ‘ cradle to grave concept’. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | A.S. Tambwekar | Safety of Ships and marine environment Protection | Institute of Marine Engineers( India) |
| 2 | -- | Safety of Life at Sea( SOLAS) Consolidated Edition | Bhandarkar Publications |
| 3 | -- | Marine pollution (MARPOL) Consolidated Edition | Bhandarkar Publications |

## (SH612) MATERIALS HANDLING AND SAFETY ENGINEERING

### 1. RATIONALE:-

The shipbuilding & ship repair industry involves handling of materials at every stage in the form of raw materials, semi finished, and finished products. A student therefore who is involved in such or related industry should have a proper knowledge of the various materials handling methods, material flow storage and warehousing, inventory control, plant layout and related functions. We are also aware that the accident occurring can do immense damage to life and property. So in the safety-engineering topic more stress is given on prevention aspects of accidents, fire fighting equipment, handling of tools and various types of hazards, safety rules etc.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH612** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| MATERIALS HANDLING AND SAFETY ENGINEERING | 4 | 0 | 2 | 6 | 75 | 25 | 25 | 25 | **150** |

*Minimum passing %: Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to understand the various material handling systems concept, material handling equipments, layouts along with the safety aspects in Shipyards.

**4. COURSE CONTENTS**

**Unit 1 Introduction to Material Handling**

Materials Handling. Definition and scope, system concept, Classification of Materials Handling- Unit and Bulk, Objectives of material handling. Unit Load concept, Pallets, Skids and Containers.
Facility location: Factors for consideration in site selection. Plants Layout and Material Handling. Types of Layout, Inter relationship between Plant Layout and Material Handling.

**Unit 2. Flow in Material Handling**

Overall system of material flow cycle. Material Handling Principles. Flow Patterns (vertical flow lines excluded). Designing of Material Flow Pattern. Material Handling equation, advantages of planned material flow. Approach to solve Material Handling problems.

**Unit 3 Materials Management**

Inventory and its Control, Inventory and its functions, need for its controls, significance of EOQ, Selective inventory Control techniques, Materials Management and its objectives, Materials Handling and Productivity.

Unit 4 **Material handling accessories**

Wire ropes, Chains, Hooks, Knots, Slings and Grabs, Chain pulley blocks, and sheaves, winches and capstan.

**Unit 5 Handling Equipments-Industrial trucks and conveyors**

- Industrial Hand Trucks: Basic types, Powered industrial Truck, Forklift, description of forklift, characteristics, application, and Maintenance aspects.
- Conveyor's-Belt conveyors, Chain conveyors.

**Unit 6 Handling Equipments-Cranes and hoists**

- Cranes: Classification, characteristics, description and application of derrick crane, Overhead crane - Bridge crane, Gantry crane, floor mounted Jib crane, Tower crane, and Mobile crane - Crawler

Crane and truck mounted crane, Hydraulic lifting equipment.

- Hoists: Manually operated, Electric power operated hoist, limit switches and overload limit device.

**Unit 7 Safety Engineering**

- Definition of Accident. Causes and costs, types of accidents, Accident report and Analysis .Safety Awareness.
- Safety Laws and Role of Factory Inspector, Regulating bodies OSHA, ANSI, etc.,
- Risk Assessment.
- First Aid, Artificial respiration etc.
- Personal Protective equipment.
- Hazards and its types
  - Machine Hazards.
  - Noise and control of noise, Dust Control.
  - Fire hazards, extinguishers, prevention of fire, types of fires.
  - Pressure vessel hazards, safety precautions in Marine Boilers.
  - Hazards in welding & gas cutting operation.
  - Electrical hazards and safety requirements.
  - Chemical hazards.
- House Keeping, Insurance coverage.
- Working in confined spaces and common explosions.

## 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Introduction to Material Handling | 07 | 12 |
| 2 | Flow in Material Handling | 08 | 12 |
| 3 | Materials Management | 04 | 06 |
| 4 | Material handling accessories | 04 | 06 |
| 5 | Handling Equipments-Industrial trucks and conveyors | 04 | 06 |
| 6 | Handling Equipments-Cranes and hoists | 10 | 15 |
| 7 | Safety Engineering | 11 | 18 |
| | | 48 | 75 |

**6. Practicals**

- Assignment on accidents and accident Report.
- Assignment on Safety Laws and Role of Factory Inspector.
- Presentation on First Aid and artificial respiration.
- Assignments of Hazards and their types.
- House keeping
- Common accidents and Insurance coverage in Shipyards.

**7. SUGGESTED LEARNING RESOURCES**

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | James M. Apple | Material Handling System Design | John-Willlwy and Sons Publication, NewYork. |
| 2 | S. C. Sharma | Material Handling and Material Management | Khanna Publishers |
| 3 | Meinsdroft | Industrial Safety | Prentice Hall |
| 4 | Saxena A. N | Industrial Safety | National Productive council New Delhi |
| 5 | R. B. Chowdary & G.R.N. Tagore. | Material Handling Equipment | Khanna Publishers |

## (FE604) QUALITY CONTROL AND INSPECTION

**1. Rationale**:- A technician engaged in quality control and inspection department is required to have necessary cognitive abilities, skills and attitudes to perform his duties with professionalism and proficiency. This course is designed to develop those abilities and skills. The theoretical aspects covered in this course should be adequately supported and reinforced through discussions of case studies and properly structured laboratory experiences. A few of the practicals on testing, for which no laboratory facilities exist in this institute should be covered during industrial training or short visits to industry. The course also aims at developing the knowledge to execute the work to the required specifications.

## 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| | L | T | P | C | TH | TM | TW | PR/OR | |
| FE604 Quality Control & Inspection | 3 | 0 | 2 | 5 | 75 | 25 | 25 | 25 | 150 |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

| **COURSE CONTENTS** | Hrs. | Mks. |
|---|---|---|
| 1.**BASIC CONCEPTS OF QUALITY CONTROL** | 6 | 6 |

Definition of quality as fitness for use, Quality characteristic, Parameters of fitness for use: a) quality of design b) quality of conformance c) abilities- i) availability ii) reliability iii) maintainability d) field service. Factors affecting quality of a product: a) market b) men c) money d) materials f) machines and methods g) miscellaneous.
Control:- Definition, Regulatory process of control. Quality control: Definition, Basic objectives, Advantages of quality control, Role of technician in promoting quality mindedness among workers and operators. Broad areas of applications of quality control: incoming materials control, process control, product control. Approach to solution of quality problems (Briefly): Engineering, Statistical Management.

| 2. **ECONOMIC OF QUALITY** | 2 | 3 |
|---|---|---|

Quality value, Quality cost, Balance between quality cost and value, Categories

of quality cost: prevention, appraisal, internal failure, external failure.

**3. INSPECTION AND TESTING** 8 12

Definition and Meaning, Difference between inspection and quality control, Aims of inspection: a) determining conformance to specifications b) planning c) procedure d) Training e) Calibration f) records g) standardization.
Classifications of inspection:- (i)based on work performance : a) Manual inspection b) Visual inspection c) Test inspection d) Automatic. (ii) Based on location: a) Process inspection b) Final inspection c) Receiving inspection d) Tool and Guage inspection. Duties of inspector: a) Interpretation of specifications b) Measurement of product quality c) comparison with standards d) Disposition of the product e) Recording data. Inspection planning a) Necessity for planned inspection: b) What to inspect c) How to inspect d)when to inspect e) where to inspect f) how much to inspect. Tools of inspection: a) Specifications b) Inspecting equipment's c) inspection records d) sampling inspection.

4. **NON DESTRUCTIVE TESTING** 12 24

Visual Inspection, Acoustic test, Radiographic Testing: a) Introduction b) principle c) X-rays and γ-rays, d) x-ray radiography e) γ rays radiography f) penetrameters g) Interpretation of radiographs h) Pitfalls in interpretations i) Advantages and disadvantages of x-ray radiography j) Fluoroscopy, k) Advantages and disadvantages of γ radiography i) Safety precautions m) Applications. Magnetic Particle Testing : a) Basic principle b) Brief description of equipment c) Flaws detected d) Scope and limitations e) Sensitivity f) Dry and Wet methods g) Sequence of operations h) Irrelevant indications i) Common applications j) Inspection of light weldment, Penetrant Inspection: a) Principle of operation b) Types of penetrant inspection system c) Test procedure d) Inspection e) Common application f) advantages g) fluorescent penetrant inspection. Ultrasonic Inspections: a) Introduction b) Principle of operations c) Basic factors in Ultrasonic testing d) Testing technique e) Techniques selection f) Evaluation g) Applications, Advantages and Limitations. Eddy Current Testing: a) Principle of operation b) Testing of non magnetic materials c) Testing of magnetic materials d) Advantages and Limitations e) Applications . Leakage Testing: a) definition b) measurement of leakage c) Types of leaks d) Types of tests i) Visual test ii) Testing under fluid pressure iii) Leakage detecting by gas iv) Water soluble paper with aluminium foil.

**5. DESTRUCTIVE TESTING** 6 12

Tensile Test a) Preparation of specimen b) Test procedure c) Test report d) Longitudinal tensile test. Compression Test: a) Principle of compression test. b) Information gained c) Practical reasons for test d) Test piece e) Practical aspects of test. Bend test: a) Introduction b) Types of bend tests c) Free bend test d) Guided bend test e) Longitudinal bend test f) Side bend test. Impact test a) Principle of test b) Types of tests) Charpy V-notes Impact test ii) Izod V-notes Impact Test c) Test procedure d) Reporting of result. Etch Test: a) Introduction b) concept and purpose c) types of Tests i) Micro –etch test ii) Macro-etch test d) Preparation of test specimen. Nick Break Test: a) Purpose b) Preparation of specimen c) Test procedure. Hardness test: a) Purpose of test b) Types of Tests c) Procedure of testing.

| | | |
|---|---|---|
| **6. INSPECTION OF PRESSURE VESSELS AND PIPES** | 5 | 6 |
| Various codes : a) A.S.M.E. b) A.S.T.M. c) D.I.N. d) I.B.R. e) Loyds Register of shipping f) G.S.T. Use of I.B.R. in Brief. | | |
| **7. SPECIFICATIONS** | 4 | 6 |
| Definition, Purpose of specification, Types: a) Contract specification b) Manufacturers specification c) Standard specification. General principle of writing specifications, Sources of information for specification: a) Previous specification b) Contract specification c) Site investigations d) Employers requirements e) I.S. codes/ I.B.R. code | | |
| 8. **MODERN TOOLS & TECHNIQUES FOR QUALITY ASSURANCE** | 5 | 6 |
| TQM, ISO 9000, 5S,Quality Circle, Zero defect, 6 sigma, Kaizen | | |
| **TOTAL** | 48 | 75 |

**TERM WORK**

The term work shall consist of any 8 of the following laboratory tests and maintenance of laboratory reports following:

Study of different defects in welded joints.

Visual Inspection & Sound Test

Dye penetrant test.

Fluorescent penetrant test

Magnetic particle test

Magnaflux testing of welds

Tensile tests on welded specimens (Welded by MMAW, GMAW and Gas Welding)

Bend tests on welded specimen

Impact tests on welded specimen

TEXT BOOKS

1. A text-book of Welding Technology by Dr. O. P. Khanna, Dhanpat Rai & Sons, Delhi
2. Quality Planning & Analysis by J. M. Juran & F. M. Gryna, TATA McGraw-Hill Pub.

REFERENCE BOOKS

1. Engineering Metrology by R. K. Jain, Khanna Pub
2. Inspection & Quality Control by M. V. V. Raman, National Productivity Council
3. Metals Handbook, ASM, Vol 6

## (ME601) MACHINE DESIGN PRACTICE

### 1. RATIONALE

Mechanical engineer/ technicians should posses the knowledge of production design & maintenance. In order to perform the jobs in this area he should have the through understanding of the working principles of the machine parts. The machine elements are subjected to forces and stresses; therefore machine parts should be designed to function for a long period of time without wear and tear. Through this course the students are introduced to simple design of the machine elements like the fasteners, coupling, levers, spring, bearing, etc. While designing data book, design handbook, etc. is to be referred so that the design is economical.

### 2. TEACHING AND EXAMINATION SCHEME

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| ME601 Machine Design | L | T | P | C | TH | TM | PR /OR | TW | 150 |
| | 4 | - | 2 | 6 | 75 | 25 | 25 | 25 | |

*Minimum passing % : Theory 40% and Practical 40%* *Duration of Theory Paper: 3 Hrs.*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – ***Design simple machine elements like fasteners, shafts, couplings etc., for given conditions.***

### 4. DETAILED COURSE CONTENT

**Unit 1 Introduction**

General procedure in machine design, General consideration in machine design, use of machine design data handbook, standardization.

**Fundamentals**

Types of external loads, concept of stress, strain, stress strain diagram for ductile and brittle materials, proof stress. Types of stresses induced: Tensile, compression, shear, bearing pressure intensity, crushing, bending, and torsion. Creep and fatigue strength, Endurance limit. Factor of safety, general consideration in selecting factor of safety. Theories of failures.

**Unit 2 Design of simple machine parts.**

Design of machine parts subjected to direct and bending stresses such as C-clamp, offset link. Design of simple machine parts like cotter joint, knuckle joint, bell crank lever, arms of pulleys,

bearing cap.

**Unit 3 Design of Shafts, keys and couplings.**

Design of shafts: Types shafts, shaft materials, standard sizes, design of solid and hollow shaft based on strength and rigidity criteria. Design of line shafts with one pulley or two pulleys in between two bearings.

Design of keys: Design of sunk key, effect of keyways on strength of the shaft.

Design of couplings:

Design of muff coupling, Design of rigid flange coupling.

**Unit 4 Design of fasteners:**

Design of screwed joints: stresses in screwed fasteners, bolts of uniform strength, design of bolted joint subjected to eccentric loading ( max 4 Nos of bolts).

**Design of welded joints:**

Design of parallel and transverse fillets welds, axially loaded symmetrical section.

Design of welded joint subjected to eccentric loading.

**Unit 5 Design of Power screws**

Thread profiles used for power screws, torque required to overcome thread friction ,self locking and overhauling condition, efficiency of power screws.

Design of screw jack (Nut and screw and handle Only )

**Unit 6 Design of springs**

Classification, application and function of springs, materials used for spring, spring terminology, wahl's stress correction factor, stresses and deflection in spring. Design of Helical compression spring with circular cross-section . Energy stored in a spring, leaf spring design and construction.

**Unit 7 Antifriction bearings**

Types of bearings, sliding and rolling contact bearing and their comparison, terminology: life; load relationship, basic static load and basic dynamic load.

Selection of bearing from the manufacturers catalogue. .

## 5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

| Unit No. | Topic | Teaching Hours/ Semester | Total Marks |
|---|---|---|---|
| 6. | **Introduction** | 8 | 9 |
| 7. | **Design of simple machine parts.** | 12 | 12 |
| 8. | **Design of Shafts, keys and couplings.** | 15 | 21 |
| 9.<br>5. | **Design of fasteners**<br>**Design of Shafts, keys and couplings.** | 12 | 12 |
| 6. | **Design of Power screws** | 6 | 6 |
| 7. | **Design of Springs** | 8 | 12 |
| 8. | **Antifriction Bearings** | 3 | 3 |
| | *Total* | **64** | **75** |

## 6. SUGGESTED LIST OF PRACTICALS

The Term work shall consists of the record of the following design assignments in the form of Journal & design sheets .

| S. No. | Unit No. | Title |
|---|---|---|
| 1 | 2 | Socket and Spigot Cotter Joint **or** Knuckle Joint. |
| 2 | 3 | Shaft with one or two Pulleys, intermediate |
| 3 | 3 | Rigid Flange Coupling. |
| 4 | 6 | Mechanical Screw Jack. |
| 5 | - | Solid Modeling of any simple machine component using any one CAD software like AUTOCAD , Pro-E, CATIA, UNIGRAPHICS, SOLID EDGE, SOLID WORKS, etc. |

## 7. SUGGESTED LEARNING RESOURCES

| S.No. | Author | Title of Books | Publication & Year |
|---|---|---|---|
| 1 | R.S.Khurmi. and J.K.Gupta | Machine Design | S Chand |
| 2 | P.L. Ballaney | Machine Design | Dhanpath rai & sons Delhi |
| 3 | Pandya and Shah | Machine Design | Charotar publishing house, Anand |
| 4. | V.B Bhandari | Design of machine elements | Tata Mc-Graw Hill |
| 5. | G.R.Nagpal | Machine Design | Khanna Publishers |

**Other learning resources**

- Different types of machine parts/components.
- Wooden cut section models of machine parts/components.
- Production drawings from industries.

**SEMESTER VII**

| Sr. No. | Course Code | Name Of The Course | Teaching Scheme | | | | Exam Scheme | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Marks | | Pr. Marks | | |
| | | | L | T | P | C | TH | TM | PR/OR | TW | |
| 1 | SH701 | Elementary Ship Design | 6 | 0 | 0 | 6 | 75 | 25 | 0 | 25 | 125 |
| 2 | E2 | Elective II | 3 | 0 | 2 | 5 | 75 | 25 | 25 | 25 | 150 |
| 3 | E2 | Institutional Elective/Elective-II | 2 | 0 | 4 | 6 | 75 | 25 | 25 | 25 | 150 |
| 4 | CS602 | Business Communication | 0 | 0 | 2 | 2 | 0 | 0 | 50 | 50 | 100 |
| 5 | SH702 | Shipyard Practice | 4 | 0 | 2 | 6 | 75 | 25 | 25 | 25 | 150 |
| 6 | SH703 | Shipbuilding Project | 0 | 0 | 6 | 6 | 0 | 0 | 50 | 50 | 100 |
| 7 | IE651 | Fibre Re-Inforced Polymers | 3 | 0 | 2 | 5 | 75 | 25 | 25 | 25 | 150 |
| **Total** | | | **15** | **0** | **16** | **31** | **300** | **100** | **175** | **200** | **775** |

ELECTIVE II

SH721 MARINE STRUCTURAL DESIGN

SH722 DEISEL ENGINE OPER. & MAINTENANCE

ME403 MECHATRONICS

FE614 OFF-SHORE STRUCTURES

IE6**-INSTITUTIONAL ELECTIVE

SH723 COMPUTER APPLICATION IN SHIP DESIGN

SH724 MARINE DRAWING PRACTICE

**SEMESTER VIII**

| **Course code** | **Name of Course** | **EXAMINATION SCHEME** | | | | **Total** |
|---|---|---|---|---|---|---|
| | | **TW** | | **PR/OR** | | |
| | | **Daily Diary** | **Progressive Assessment** | **Training Report** | **Report Assessment & Seminar/ Viva** | |
| SH801 | Inplant Training Phase II | **50** | **50** | **50** | **50** | **Grade** |

FOR INDUSTRIAL TRAINING OF V$^{TH}$ & VIII$^{TH}$ SEMESTER:

4. Grades will be awarded based on marks scored as follows:
   e. 80% and above Marks – Grade 'A'
   f. 60% to 79% Marks – Grade 'B'
   g. 40% to 59% Marks – Grade 'C'
   h. Marks below 40% - Grade 'D'

5. TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade 'C' for passing.

6. Student with Grade D under the Head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D under the head PR/OR, shall be declared Failed/ATKT.

# SEMESTER VII

## (SH701) ELEMENTARY SHIP DESIGN

### 1. RATIONALE:-

The course content is designed to enable the students to understand design features of various ships, factors influencing design, rules and regulations of statutory bodies. The design stages in Ship design process as considered in Design spiral to be explained to the students.The students should also be introduced to submission drawing like general Arrangement Freeboard Calculation and Tonnage Calculations. They should also be explained about Specifications and Contracts prepared during preliminary stage.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH701** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| ELEMENTARY SHIP DESIGN | 6 | - | - | 6 | 75 | 25 | 25 | -- | **125** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency –to understand the design process involved in shipbuilding and the allied requirements of Ship design.

## *4.* COURSE CONTENTS

**Unit 1 Factors in concept design**

Specific design features of different ships, Trading patterns, Owner's requirement. Ship Design Data.

**Unit 2 Preliminary design**

- Design spiral
- Determination of main dimensions: Dimensional Relations and ratios. Design categories- Deadweight carrier, volume carrier, displacement equation, volume equation and displacement coefficient. Checking of preliminary dimensions for deadweight
- Estimation of form coefficients and hydrostatic particulars.
- Lightship Weight and Machinery Weight estimation. Light ship mass-Steel mass, outfit mass, engine plant mass, power estimation, Admiralty coefficient.
- Estimation of cargo capacity.
-

**Unit 3 . Freeboard, Tonnage and Subdivision Requirements**

- Freeboard, tonnage, stability and subdivision of ships.
- Freeboard requirements, Tonnage requirements, Sub-division requirements.
-

**Unit 4 . Stability and Trim Requirements**

- Merchant ship stability standards
- Intact stability standards
- Trim and stability booklets (Trim fully loaded and Ballast trim)
-

**Unit 5. Machinery Selection**

- Introduction and criteria for choosing the main engine
- Selection of Main engine types such as slow-speed diesels, Medium-speed diesels & High-speed diesels.
- Selection of Auxiliary Power.
- List of other engine room auxiliaries and equipment
- Fuel economy through Ship Design-Introductory concept.
-

**Unit 6 General arrangement**

- Introduction.
- Factors influencing the general arrangement
- Location of cargo spaces ,and machinery spaces

- Cargo spaces.
- Machinery spaces.
- Crew, passenger accommodation, and galley, safety regulations.
- Passages and Stairs

**Unit 7 Other Statutory Rules**

Safety Plan

- Fire Protection: Zones, A class divisions, Means of escape and fire detection and extinguishing rules.
- Life Saving Appliances: Passenger Ship Requirements and Cargo Ship requirements

**Unit 8 Specification and contracts**

## 5. SPECIFICATION TABLE WITH HOURS & MARKS

| Unit No. | Topic | Theory Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Factors in concept design | 7 | 06 |
| 2 | Preliminary design | 45 | 32 |
| 3 | Freeboard, Tonnage and Subdivision Requirements | 7 | 06 |
| 4 | Stability and Trim Requirements | 6 | 06 |
| 5 | Machinery Selection | 8 | 06 |
| 6 | General arrangement | 11 | 09 |
| 7 | Other Statutory Rules | 7 | 06 |
| 8 | Specification and contracts | 5 | 04 |
| | | 96 | 75 |

### 6. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | H. Schneekluth | Ship design for Efficiency & Economy | Butter Worths |
| 2 | John Comstock | Principles of Naval Architecture | SNAME |
| 3 | Taggart | Ship design and construction | SNAME |
| 4 | Munro-Smith. | Elements of Ship Design | IME, London |
| 5 | D.G.M. Watson | Practical Ship Design | Elsevier Ocean Engg. book series |

## (SH702) SHIPYARD PRACTICE

### 1. RATIONALE:-

The course content is designed for students to understand the general aspects of construction as outlined in Shipbuilding Engineering Course. It is designed for students to understand fairing of lines, the subsequent marking and cutting of plates and the production practices followed in a Shipyard. The students should know the installation and testing of various ship's machinery, equipment & systems carried out during construction phases. The students should know launching arrangements and test & trials during and on completion of hull construction.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| SH702 | L | T | P | C | TH | TM | TW | PR/OR | |
| Shipyard practice | 4 | 0 | 2 | 6 | 75 | 25 | 25 | 25 | 150 |

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Understanding the process from design and drawing to actual concepts of construction, outfitting and commissioning practices in Shipyards. Understand the use of computers progressively at a larger extent and reduction of manual processes by semi-automated and automated processes, as are being carried in modern shipyards now.

4. **COURSE CONTENTS**

**Unit 1. Hull construction**

Fairing of full-scale lines and shell expansion, shell development and frame lines marking, cutting (Manual and Computer aided). Prefabrication- plates preparation, template making, construction skids. Block construction and advanced outfitting. Building berth/dock and construction on an inclined slipway. Erection, assessment of weights and position of C.G. of prefabricated unit, sequence of erection and welding alignment of members, consolidation & tests.

**Unit 2. Machinery installation & alignment**

Stern gear and rudder gear installation and alignment, machinery installation, pre-launching checks, installation of steering gear, main propulsion shafting and engines alignment.
Line Boring

**Unit 3. Launching and Ship Trials**

Arrangements and process for launching of ships, dock trials, Inclining experiment, sea trials and delivery.

**Unit 4. Planning in shipyards**

Flow-chart, Bar chart, Pert, CPM, procurement of material, material scheduling.

**Unit 5. Safety aspects**

- Personal Protective equipment.
- Hazards and its types
  - Machine Hazards.
  - Noise and control of noise, Dust Control.
  - Pressure vessel hazards
  - Hazards in welding & gas cutting operation.
  - Electrical hazards and safety requirements.
  - Chemical hazards.
  - Fire hazards
- House Keeping.
- Working in confined spaces and common explosions.

### 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | **Hull construction** | **22** | **27** |
| 2 | **Machinery installation & alignment** | **15** | **18** |
| 3 | **Launching and Ship Trials** | **15** | **18** |
| 4 | **Production planning** | **06** | **06** |
| 5 | **Safety aspects** | **06** | **06** |
| | | **64** | **75** |

### 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of the competency.

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | Fairing of full-scale lines. |
| 2 | 1 | Shell Expansion |
| 3 | 2 | Anchor Calculations |
| 4 | 2 | Rudder Calculations |
| 5 | 3 | Sea Trails |
| 6 | 4 | Specimen of flow chart, bar chart – PERT & CPM |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | D. A. Taylor | Merchant Ship Construction | Buttersworth Hienemann |
| 2 | R. Taggart. | Ship Design & Construction | SNAME |
| 3 | D.J Eyres | Ship Construction | Elsevier |

## (SH703) SHIPBUILDING PROJECT PHASE II

### 1. RATIONALE:-

Any student should be able to identify a shipbuilding problem. Solution of a problem involves definition of problem, background data to analyse the problem, analysis of data, alternative solution and positive solution with conclusion.

Objective: To develop the skill to identify the problem and to develop attitudes. To take steps to seek solution to the problem in above particular steps. To develop skill of reporting the matter (report writing). To develop skills to communicate the problem and solutions (seminar).

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH703** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| SHIPBUILDING PROJECT PHASE II | 0 | 0 | 6 | 6 | - | - | 50 | 50 | **100** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COURSE CONTENTS

- Each student or a small group of students may take up any one of the following under the guidance of a competent staff member of institute or Senior Engineer from industry in the areas of :
  - ✓ Ship design
  - ✓ Ship Construction and repair

- ✓ Marine Engineering

- The topic identified could contain study matter of some particular aspect on one of the subjects at fourth, sixth and seventh semesters.
- Literature/ Trends survey and Data collection.
- Project work
  - ➢ Analyse the above data on the topic identified.
  - ➢ Alternate Solution if any to be provided.
  - ➢ Design if any to be explained.
  - ➢ Fabrication process if any to be elaborated
  - ➢ Various calculations done to be produced.
  - ➢ Optimization of the solution.
  - ➢ Conclusion to the project.

**Notes:**

- A daily diary should be maintained wherein records of day to day activities shall be recorded and shall be duly attested by Project Guide.
- Dissertation should be prepared with focus on Lucidity, drawing and sketches.
- Group Behaviour with Co-ordination of the groups; Managing the tasks & situations and taking group decisions will be encouraged.
- Project should develop Leadership qualities, Attitudes, Efforts, and belongingness to the group.

**Assessment:**

- ➢ The project should be evaluated by giving due emphasis to the following parameters: Selection of project topic, Data collection, problem definition. Alternate Solution, Optimization of the solution and Conclusion.
- ➢ A project report has to be prepared at the end of the term.

## (CS602) BUSINESS COMMUNICATION

### 1. RATIONAL :

**The course on Business Communication will help in development of speaking, listening, writing, and reading skills in students, with special reference to business environment like writing business letters, notes, reports, documents, holding meetings and discussions, working in groups, etc. . Special provision has been made for language workshops where the communication skills of the students can be enhanced.**

### 2. Teaching and Examination Scheme :

| Course Code & Course title | Periods per week in hours | | | Total credits | Examination scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | TOTAL Marks |
| | L | T | P | C | TH | TM | PR/OR | TW | |
| CS602 Business Communication | - | - | 2 | 2 | - | - | 50 | 50 | 100 |

### 3. Competences to be developed through this course:

**The course content should be taught and implemented with the aim to develop different type of skills leading to the achievement of the competency "Communicate effectively in given Business situations''.**

### 4. Detailed Course Content :

| | |
|---|---|
| | **Unit 1.1: Communication Skills in the work place**<br>Communication within the organizational, Types of communication, functions of Internal & external communications<br>Definition, components, importance of effective communication skills, types- verbal-non verbal, methods and hints to improve communication skills, body language, Précis and comprehension |
| | **Unit 1.2: Modern Office technology for communications:** Using technology and internet to **obtain** information about suppliers, their credibility, latest specification of items, contacting people, quick feedback, social networking, skype, whatsapp, spell check, **dissemination** of information, send email to staff, paperless office, etc |
| | **Unit 2.1: Seminars**<br>Objectives, topic selection, audience, structure, tips for good beginning and end, aids to presentation. |
| | **Unit 2.2: Project work:** A link between the theory and the practical Tips: Narrow down to the topic, specific not vague, data collection, structure, critical thinking and analysis. |

| |
|---|
| **Unit 3.1 : Report writing:** Understanding Objective and Subjective report writing<br>(i)Feasibility report: Definition, types, economic feasibility, technical feasibility, definition.<br>(ii) Trouble Report: Purpose, instances when trouble reports are written, procedure followed in writing trouble report<br>(iii) Formal Reports: Essay, Pamphlet, Booklet or Book report, Parts of a book Report, understanding how to write formal reports |
| **Unit 3.2 : Illustrations in a report**: Uses, types, Use of illustrations: Tables, graphs, charts, Venn diagram, organizational charts, flow charts, maps, photographs, drawings and diagrams. |
| **Unit 4.1: Topic -Letter writing:** Credit letter, Collection and sales letters |
| **Unit 4.2: Memorandum:** Definition, difference from letter, examples of memorandum |
| **Unit 5.1: Meetings**: Preparation, Notice for the meetings, Agenda |
| **Unit 5.2.:** Note taking during meetings, minutes of meeting |
| **Unit 6.1: Tender:** Procedure, Preparation, Types of tenders, Single tender, local tender, e tender, Structure, Tender Notice, Terms and conditions, Payment details, specification, Documents to be submitted, placing orders, Evaluations, drafting advertisements for tenders |
| **Unit 7: Job Interviews:** Preparing for a Job Interview, guidelines on facing job interviews, ways of scouting for jobs, Writing Job Application, resume, |

**Marking scheme :**

**Term Work** **Maximum marks**

Overall classroom performance……..…….10

Workbook (assignments)…… ……25

Classroom activity (language workshop)…… ……....15

**Term End Assessment**

**Components** **Maximum marks**

Questions on syllabus……..20

Activity……..30

5.. **Suggested specification table with hours and marks (Practical) :**

| Unit No | Topic | Teaching hours per semester |
|---|---|---|
| 1. | Communication Skills in the work place | 04 |
| 2. | Organizing seminars, project work | 04 |
| 3. | Report writing | 05 |
| 4. | Letter Writing | 05 |
| 5. | Meeting | 05 |
| 6. | Tenders | 04 |
| 7. | Job interviews | 05 |
| | Total hours | 32 |

**6. Suggested learning resources :**


1. Business Correspondence and report writing, by R C Sharma & Krishna Mohan, Tata Mcgraw hill, New Delhi 2002,
2. Principles and practices of Business Communication ,Doctor R. Doctor A., Seth Publishers,14th edition,2006
3. The functional aspects of communication skills, P. Prasad, Sharma K. Rajendra, S. K. Kataria and Sons,2006
4. Raul R. Timm, How to make winning presentations, Sneha printers, Mumbai,
5. Stand and Deliver, how to become a masterful communicator and public speaker,
6. Dale Carnegie Training, CPI Cox & Wyman, UK.

## (SH721) MARINE STRUCTURAL DESIGN

### 1. RATIONALE:-

A general survey carried out to determine the competencies required by a diploma in Shipbuilding Engineering student revealed that the student should have an elementary knowledge of Marine structure design. The knowledge that he acquires in this subject is essential to a student of Shipbuilding Engineering. In view of this emphasis has been laid on topics like structural analysis of beam, thin plates, column and stiffened plate.

### 2.TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH721** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | **150** |
| Marine structural Design | 3 | 0 | 2 | 5 | 75 | 25 | 25 | 25 | |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency – To understand the design of important structural members in Ship Structure

## *4.* COURSE CONTENTS

**Unit 1. Loads in ship and offshore structures**

- Longitudinal strength loads
- Transverse strength loads
- Local strength loads
- Ship response calculation in waves

**Unit 2: Design of Beams**

- Effective Breadth of Attached Plates
- Span Point of Beams
- Design of Cross Section of beam
- Calculation of Section Modulus of beam
- Bending Moment of shell plate as a beam with uniform load and concentrated load.
- Shear centre of simple cross sections
- Effect of Struts

**Unit 3: Statically Indeterminate Beams**

- Easy Solution of Statically Indeterminate Beams
  - ✓ Continuous Beam.
  - ✓ Boundary Condition of beams in ships.
  - ✓ Simply Supported Beams and Continuous Beams.
  - ✓ Clapeyron's three moment equation.

**Unit 4: Design of Pillars**

- Definition of columns and struts.
- Definitions of bucking stress, slenderness ratio & equivalent length of column.
- Application of Euler's formula (no derivation) and Rankine's Formula.
- Connection of Pillar at Top and Bottom
- Pillar Supporting Tensile Force
- Cross Ties

**Unit 5 Design of Plates**

- Boundary Conditions of Plates.
- Strength of Plates Under Lateral Loads
- Strength of Plates by In-Plane Loads
- *Design of Stiffened Panel*
  - ✓ Grillage Structure
  - ✓ Optimum Spacing of Girders
  - ✓ Optimum Spacing of Beams
  - ✓ Design Condition Against Lateral Load like Water Pressure
  - ✓ Minimum Plate Thickness.

| |
|---|
| **Unit 6. Bulkheads structure**<br>• Strength of Bulkhead Plates<br>• Strength of Horizontal stringers on Transverse Bulkheads<br>• Horizontal stringers Arrangement on Bulkheads.<br>• Strength of Vertical Stiffeners on Transverse Bulkheads. |
| **Unit 7. Introduction to Finite Element Method**<br>• Characteristics of FEM<br>• Fundamentals of FEM<br>✓ Stiffness Matrix<br>✓ Plane Stress<br>• Procedure of FEM<br>• Application of FEM<br>• Mesh Division<br>• Loading and Supporting Condition<br>• Degrees of Freedom |

### 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | Loads in ship and offshore structures | 06 | 09 |
| 2 | Design of Beams | 08 | 12 |
| 3 | Statically Indeterminate Beams | 10 | 18 |
| 4 | Design of Pillars | 08 | 12 |
| 5 | Design of Plates | 06 | 09 |
| 6 | Bulkheads structure | 06 | 09 |
| 7 | Introduction to Finite Element Method | 04 | 06 |
| | | 48 | 75 |

### 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of the competency –

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | Assignment on wave load calculations |
| 2 | 2 | Assignment on calculation of effective breadth and span point of beam. |
| 3 | 3 | Assignment on bending moment and Shear force diagram for continuous beams |
| 4 | 4 | Assignment on detailed bottom and top end connections of pillars and cross ties |
| 5 | 6 | Assignment on determining the optimum spacing of stiffeners and girders in Bulkheads |
| 6 | 7 | Establish the stiffness matrix of any loaded structural Member. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | Yasuhisa Okumoto, Yu Takeda, | DESIGN OF SHIP HULL STRUCTURES | Springer |
| 2 | S Ramamurutham | Strength of Materials | Dhanpat Rai & Sons |
| 3 | F.L. Singer | Strength of Materials | London Harper and Row |
| 4 | | Strength of Materials | Schaum Series |
| 5 | Timoshenko and Gere | Mechanics of materials | CBS Publishers and distributors New Delhi. |

## (SH722) DIESEL ENGINE OPERATION & MAINTENANCE

### 1. RATIONALE:-

The course content is designed for students to specialize in heat power engineering and to have thorough knowledge of the operation and maintenance of the most widely used prime mover, the diesel engine. The course provides for familiarization with the various applications of diesel engine, engine systems and role of maintenance associated with them. Wide range of actives vis-à-vis operations of diesel engine are also covered in this course. The course aims at providing a brief introduction to various maintenance strategies and thorough knowledge about troubleshooting and over hauling of diesel engines.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| SH722 | L | T | P | C | TH | TM | TW | PR/OR | |
| Diesel Engine Operation & Maintenance | 3 | 0 | 2 | 5 | 75 | 25 | 25 | 25 | 150 |

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency – To understand the diesel engine components, systems, its maintenance and trouble shooting.

4. **COURSE CONTENTS**

**Unit 1. Diesel engine systems**

Operation circuit, components, functions of

- Air intake system, scavenging, super-charging
- Cooling system, methods of piston cooling.
- Lubricating system, lubricating oil properties, multi-grade oils, need for oils, need for oil change, cylinder lubrication.
- Fuel system types, system requirement, fuel line priming, fuel oils.
- Starting systems.

**Unit 2. Diesel engine operation**

- Starting of diesel engines, precautions to be taken, operating parameters, maintaining records of operation.
- Operation of fuel pump, injector, Governor,
- Turbocharger,
- Attached pump, gear pump.
- Crankcase ventilation, crank-case explosion, scavenge fire, cylinder relief valve.
- Engine cut-out due to lubricating oil, cooling temperature and overspeed control

**Unit 3. Diesel engine maintenance**

- Introduction to various maintenance strategies, preventive maintenance checks for different system, standard maintenance chart. Predictive Maintenance – concept and implementation.
- Trouble shooting chart and failure analysis.
- Engine tune-up-valve tappet clearance.
- Need for overhauling, diagnosis before overhauling.

**Unit 4. Tools & spares**

- Tools used such as Torque wrench spanners, feeler gauges, dial gauges, bore gauges, piston expander.
- Spare parts and catalogues.

**Unit 5. Engine overhauling as applicable to medium speed 4 stroke engine**

Assembly and dismantling of:

- Cylinder head.
- Rocker arm-valve assembly.
- Piston- connecting rod assembly.

Inspection and servicing of engine components like main bearings, cylinder block, liners, crankshaft, piston and rings, valves.

Salvaging of worn out components. Crankshaft grinding, line boring, honing, valve grinding.

Commissioning of overhauled engine.

Safe working practices.

## 5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

| Unit No. | Topic | Teaching Hours/Semester | Marks |
|---|---|---|---|
| 1 | **Diesel engine systems** | **09** | **15** |
| 2 | **Diesel engine operation** | **12** | **18** |
| 3 | **Diesel engine maintenance** | **10** | **16** |
| 4 | **Tools & spares** | **05** | **8** |
| 5 | **Engine overhauling** | **12** | **18** |
| | | **48** | **75** |

## 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented with an attempt to develop the different type of skills leading to the achievement of the competency.

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 5 | Dismantling and assembly of Diesel Engine |
| 2 | 5 | Study/inspection for defects of engine components. |
| 3 | 2 | Demonstration/construction/testing of a fuel injector. |
| 4 | 3 | Engine tune-up : Adjustment of valve tappet clearance. |
| 5 | 2 | Study of lubricating system components. Gear Pump |
| 6 | 4 | Demonstration of the use of hand tools like torque wrench etc. |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | Boyce Dwiggins | Automobile Repair Guide | Taraporewala, Mumbai |
| 2 | Kirpal Singh | Auto Engg. | Standard Publishers |
| 3 | D. A. Taylor. | Introduction to Marine Engineering | Elsevier, Delhi |
| 4 | A.J. Wharton. | Diesel Engines | Elsevier, Delhi |
| 5 | Mathur & Sharma | A course in internal combustion engine | Dhanpat Rai Publications |

## (SH723) COMPUTER APPLICATION IN SHIP DESIGN

### 1. RATIONALE:-

The course content is designed to enable the students to have introductory knowledge of modern ship design process using computers which will help students to appreciate the latest technology developed in this field. The students will be introduced to Ship Design software for basic design and detailed design.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH723** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| COMPUTER APPLICATION IN SHIP DESIGN | 2 | 0 | 4 | 6 | 75 | 25 | 25 | 25 | **150** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 3 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop introductory knowledge of computer aided design of ships in basic design and detailed design.

## 4. COURSE CONTENTS

**Unit 1 Hull form design**

Sectional Area Curve. Development of Sectional area curve from main particulars. Modification of sectional area curve of the basis ship. Development of lines from sectional area curve.

**Unit 2 Freeboard Calculations & Tonnage Calculations**

Freeboard, Load Line rules, Load Line marking. Types of freeboards. Calculations of freeboard and freeboard corrections.

Enclosed spaces and Exempted spaces. Calculation of enclosed spaces and exempted spaces. GRT and NRT. Tonnage rules and certificate. Calculations of GRT and NRT.

**Unit 4 Basic Design**

Development of Hull forms.

- Defining hull geometry
- Various forms of data input,
- Performing calculations for curve or surface generation.
- Producing output (numerical and graphics reports)
- Interactive development of hull form using basic parameters.

Determination of Hydrostatic data, intact and damaged stability using specific Ship design Software .

- Computation of capacities
- Computation of Hydrostatics
- Computation of Intact Stability
- Computation of damaged stability

**Unit 5 Detailed Design**

- Detailed design of basic structural sub assemblies
- Detailed design of Hull components.
- Generation of database of hull components and use of the same for detail design
- Generation of production documents using specific ship design software .

**Unit 5 Strength curves**

Determination of steel weight distribution, Machinery weight distribution and deadweight distribution.

Development of Weight curve, Buoyancy Curve, Load Curve, Shear force and bending moment diagram for ship structure.

Determination of longitudinal strength using specific Ship design Software.

### 5. SPECIFICATION TABLE WITH HOURS & MARKS (Termwork )

| Unit No. | Topic | Theory Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Hull form design | **10** | **24** |
| 2 | Freeboard Calculations & Tonnage Calculations | **07** | **18** |
| 3 | Basic Design | **05** | **09** |
| 4 | Detailed Design | **03** | **06** |
| 5 | Strength curves | **07** | **18** |
| | | **32** | **75** |

### 6. SUGGESTED LIST OF EXPERIMENTS

The assignment should be properly designed and implemented towards **usage of software( Ship design analysis software and Ship detailing software)** for the followings

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 1 | 1 | Assignment on Hull form generation |
| 2 | 3 | Assignment on Strength curves generation |
| 3 | 4 | Assignment on intact and damaged stability. |
| 4 | 5 | Assignment on Bulkhead drawing and midship drawing |
| 5 | 5 | Assignment on double bottom- 3D detailed model/drawing |

## 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | Rawson, K.J. & Tupper. | Basic Ship Theory Vol.1 & 2 | Longman |
| 2 | Edward V. Lewis | Principles of Naval Architecture | SNAME |
| 3 | D.J. Eyres. | Ship Construction | Butterworth Heinemann |
| 4 | Eric Tupper | Introduction to Naval Architecture | Butterworth Heinemann |
| 5 | Baxter, B. | Naval Architecture Examples and Theory | Charles Griffin & Co |
| 6 | Taggart | Ship Design and Construction | SNAME |
| 7 | NA | Rules for Building and Classing Steel vessels | American Bureau of Shipping |
| 8 | NA | Classification of Ship-Rules and Regulation | Lloyd's Register of Shipping. |

## (SH724) MARINE DRAWING PRACTICE

### 1. RATIONALE:-

Technical drawing is a universally accepted language used by engineers. The technical drawing must be clear, unmistakable in meaning and interpretation. Students undergoing shipbuilding shall come across situations where they will need to sketch simple views of machine parts which may need to be assembled and the whole assembly would require to be checked for its working. This course introduces the students to some of the many engineering components, learning to sketch them and prepare assembly drawing. These drawings thus help to represent the proper working relationships of the several components of a structure or mechanism.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **SH724** | **L** | **T** | **P** | **C** | **TH** | **TM** | **TW** | **PR/OR** | |
| MARINE DRAWING PRACTICE | 2 | 0 | 4 | 6 | 75 | 25 | 25 | 25 | **150** |

*Minimum passing % : Theory 40%* *Duration of Theory Paper: 4 Hrs.*

***Legends:***

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

Course content should be thought and implemented with the aim to develop different types of skill leading to the achievement of competency –to understand and produce technical drawing in marine industry.

## *4.* COURSE CONTENTS

**Unit 1 Introduction to Machine features:**

- onventional representation of common machine features.
- o draw hexagonal headed, square headed bolt and nut.
- sing approximate method to draw the teeth profile of a spur gear, and spring.

**Unit 2 Intersection of Surfaces:**

- ntersection of surfaces:
  Importance of intersection of objects, drawing intersection of cylinder with cylinder to represent pipe joints.
- evelopment of pipe bend/elbow.

**Unit 3 Sectional Views:**

- **Sectional views:**
- ypes: Full section, Half section, Offset section, Partial section, Removed section, Aligned section.
- ectional view of simple isometric/3D objects.

**Unit 4 Assembly Drawing:**

**(Type A)**

- Assembly drawing: Introduction and importance. **Choosing appropriate scale**. To draw assembly drawing full section front view of parts shown in Orthographic section.
- N on return valve.
- S tuffing box.
- F ootstep bearing.
- I C engine piston ( trunk type).

**(Type B)**

Drawing of full sectional front view assembly of parts shown disassembled in isometric sections.

| | |
|---|---|
| • ilge suction strainer.<br>• ealed Ball joint.<br>• ear pump.<br>• ylinder Relief valve. | B<br>S<br>G<br>C |
| **Unit 5 Free hand sketching**<br>• eys –Sunk taper key, Saddle key, Woodruff key , Spline shaft<br>• oints- Socket and spigot joint, Universal coupling.<br>• ashers, eye bolt, cup headed bolt, stud, castle nut, eye foundation bolt. | K<br>J<br>W |

### 5. SPECIFICATION TABLE WITH HOURS & MARKS (Termwork )

| Unit No. | Topic | Theory Hours/ Semester | Marks |
|---|---|---|---|
| 1 | Introduction to Machine features. | **6** | **15** |
| 2 | Intersection of surfaces. | **5** | **12** |
| 3 | Sectional views | **6** | **15** |
| 4 | Assembly drawing | **12** | **25** |
| 5 | Free hand sketching | **3** | **08** |
| | | **32** | **75** |

### 6. SUGGESTED LIST OF ASSIGNMENTS

| Sr. No. | Unit No. | Assignment |
|---|---|---|
| 01 | 01 | Assignment to draw spur gear profile. |
| 02 | 02 | Assignment on Intersection of two cylinders. |

| | | |
|---|---|---|
| 03 | 03 | Assignment on sectional views. |
| 04 | 04 | Full sectional F.V. Assembly drawings. |
| 05 | 05 | To prepare free hand sketches |

### 7. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title of book | Publication |
|---|---|---|---|
| 1 | R. V. Mali<br>B. S. Chaudhari | Mechanical Engineering Drawing | Vrinda Publication |
| 2 | N. D. Bhatt | Machine Drawing | Charotar Publishing House |
| 3 | | Reeds Engineering Drawing for Marine Engineers. | |

## (ME403) MECHATRONICS

### 1. RATIONALE:

Rapid development in technology and competitive economy has led to development of new trends in manufacturing industry such as CNC machines, Automation, FMS etc. which consists of combination of mechanical, Electrical and Electronics systems. Diploma engineer in professional life has to operate and maintain systems being developed in the area of mechatronics. In view of this, it is important for him to understand fundamental facts, concepts, principles and application of mechatronics systems which enables him to work as technician to adopt an interdisciplinary approach of engineering while working on shop floor.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| | L | T | P | C | TH | TM | TW | PR/OR | |
| (ME403) MECHATRONICS. | 3 | - | 2 | 5 | 75 | 25 | 25 | 25 | 150 |

***Minimum passing % :*** *Theory 40%* ***Duration of Theory Paper:*** *3 Hrs.*
***Legends:***

***L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:***

***PR/OR - End Semester Practical / Oral Examinations; TW- Term Work***

3. **COURSE CONTENTS**

**Unit- I– Introduction of Mechatronics**

Introduction to mechatronics,Traditional V/S Mechatronics Approach, Block Diagram, Representation of General Mechatronics system showing various components with suitable example, Elements of Measurement systems, Control system: Open loop & Closed loop Control system with block diagram, Application of Mechatronics in Industry.

**Unit- II – Sensors**

Introduction to sensors and Transducers, Difference between sensor and transducer, Performance Terminology related with sensor, static and dynamic characteristics, practical(Functional) application of Displacement, position, proximity, velocity, motion, force, pressure, flow, liquidlevel, temperature, light sensors, selection criteria of sensors, Introduction to smart sensors.

**Unit- III – Signal Conditioning, Data Acquisition, data presentation systems**

General Measurement system components, Necessity of signal conditioning, Process of signal conditioning, Function of Signal Conditioning Equipment, Introduction to DAQ Systems (simple Block diagram and elements of DAQ systems,), Introduction to Data presentation systems ( Different elements available for presentation systems)

**Unit-IV – Actuations Systems**

Introduction and Classification of Actuators, Need for an actuation system.

**Pnuematic Actuation System:** Basic Elements of Pnuematic System

**Hydraulic Actuation Systems:** Basic Elements of hydraulic system.

Valves: Direction control valves( 3/2 DC Valve, 5/2 DC Valve) ,Non Return valves, Pressure Control valves, Flow control Valves valve Symbols (Graphical Representation)

Cylinders: Single Acting and Double acting cylinder.

Rotary Actuators: Gear motors and Vane Motors.

Drawing of simple pneumatic circuit using above symbols.

**Electrical Actuation systems**: Switching devices: Relays, Solenoid type devices: Solenoid valves, Drive systems: Stepper Motor.

( Brief Working with neat sketches)

**Unit-V – Microprocessor and Microcontroller**

Microprocessor: General block Diagram (General Architecture)

Microcontroller: Basic Block diagram.

Comparison between microprocessor and microcontroller.

**Unit-VI – Programmable Logic Controller (PLC)**

Introduction to PLC: Basic PLC Architecture (Block diagram), Advantages, Characteristics of PLC. *Selection of PLC based on Applications(type of brand).*

Input/output processing.

Concept of Ladder Diagram , Ladder programming based on logic functions, Latching, internal relays, timers, counters.

(Ladder diagram development should be of Elementary level like Motor start and stop).

**Unit- VII- Mechatronics Systems**

Case studies of Mechatronics systems : Engine Management system, Automatic Washing machine, Automatic camera. ( Brief description with sketches)

Advancements in mechatronics: Microelectromechanical Systems (MEMS)( Introduction Level Only).

**4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)**

| Unit No. | Unit | Teaching Hours / Semester | Marks |
|---|---|---|---|
| **I** | **Introduction of Mechatronics** | 3 Hrs | 06 |
| **II** | **Sensors** | 6Hrs | 09 |
| **III** | **Signal Conditioning, Data Acquisition, data presentation systems** | 4 Hrs | 06 |
| **IV** | **Actuations Systems** | 14 Hrs | 24 |
| **V** | **Microprocessor and Microcontroller** | 03Hrs | 06 |
| **VI** | **Programmable Logic Controller (PLC)** | 12 Hrs | 15 |
| **VII** | **Mechatronics Systems** | 06 Hrs | 09 |
| | **Total** | **48Hrs** | **75Mks** |

**5. SUGGESTED LIST OF EXPERIMENTS**

**1) Identification, working and displaying waveforms for different Sensors used in Automated System.**

Temperature sensor, Pressure sensor, Flow sensor, level sensor, proximity sensor. Force sensor Etc.

2) **Identification, working of different Actuation systems**

Relays, Soleniod valve, stepper motor, Valves, cylinders etc.

3) **Development of ladder diagram, programming using PLC for ( Any two)**

i) Water Level control by PLC

ii) Elevator Control

iii) Conveyor Belt control

iv) Traffic Light control

v) Measurement of speed of a motor.

4) **Experiment to build any two simple Pneumatic circuit systems in Automation.**

5) **Experiment to build any two simple Electro pneumatic systems in Automation**

**6) Automatic Process control: To study basic temperature control principles.**

**or**

**6) Working of Automated system like: FMS, AS/RS, Pick and Place robot etc**

## 6. SUGGESTED LEARNING RESOURCES

| Sr.No. | Author | Title | Publication |
|---|---|---|---|
| 1 | W. Bolton | Mechatronics | Pearson Education Ltd |
| 2 | R. K. Rajput | Mechatronics | S. Chand Publications |
| 3 | Pnuematic Controls | Joji P. | Wiley-India Publications |
| 4 | James L. Johnson | Introduction to Fluid Power Control | Delmar- Thomson Learning |
| 5 | John. W. Webb and Ronald Reis | Programmable Logic Controller | Prentice Hall of India |
| 6 | Histand B.H and Alciatore D.G | Introduction to Mechatronics and Measurement systems | Tata- McGraw Hill Publishing |
| 7 | Kolk R.A and Shetty D. | Mechatronics Systems Design | Vikas Publishing New Delhi |

## (FE614) OFF-SHORE STRUCTURES

### 1. TEACHING AND EXAMINATION SCHEME:

| Course Code & Course Title | Periods/ Week (In Hours) | | | Total Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| (FE614) OFF-SHORE STRUCTURES | L | T | P | C | TH | TM | TW | PR/OR | 150 |
| | 3 | - | 2 | 5 | 75 | 25 | 25 | 25 | |

| COURSE CONTENTS | Hrs. | Mks. |
|---|---|---|
| 1. OCEAN RESOURCES<br>Minerals- polymetalic nodules, placer deposits, oil and gas, gas hydrates | 2 | 4 |
| 2. OCEAN ENVIRONMENT<br>Waves - wave height, wave period, wave direction, design wave height.<br>Tides-different tide levels.<br>Currents- Variation of currents with depth.<br>Wind-Variation of Wind speed and direction, wind speed during cyclones.<br>Seabed characteristics- brief note on marine geotechnical investigations, geophysical survey, drilling and sampling procedures, in situ testing techniques.<br>Temperature and salinity variations with dept. | 5 | 08 |
| 3. TYPES OF OFFSHORE STRUCTURES INCLUDING BASIC DESIGN CRITERIA<br>Exploratory drilling structures- Jack-up-rigs, semi-submersibles, drill ships, Productions platforms- fixed structures (gravity and piled) – compliant structures (TLP and articulated tower) Single point mooring system; Mention of forces acting on the structures. | 12 | 16 |
| 4. SUBMARINE PIPELINES<br>Installation methods- Lay barge method, reel barge method, tow method, pipeline trenching methods- Jetting method, mechanical cutting, fluidization method, plowing method. | 5 | 08 |
| 5. EQUILIBRIUM OF FLOATING BODIES<br>Archimedes Principle; Buoyancy centre of Buoyancy- Metacentre – Type of equilibrium of floating body- maximum length of body floating in water; Numerical problems. | 8 | 12 |
| 6. MATERIALS AND FABRICATION IN MARINE ENVIRONMENT<br>Steel structures for offshore environment- types of steel and its strength requirements, fabrication and welding details - erection of structural steel- coatings and corrosion protection – Non-destructive testing of weld, concrete mixes and their proportion concept of pre- stressed concrete – placing of concrete – curing. Causes failure and of structures. | 8 | 12 |
| 7. CONSTRUCTION TECHNOLOGY<br>Marine operations – cranes – barges – derrick barges – jack-up barges, launch barges: Installation of offshore structure – steel jackets – removal of jacket from barge lifting and launching – installation on the sea floor; Diving and underwater works: underwater concreting and grouting: Repair and maintenance of offshore structures, Repair methods – surface welding, hyper – baric welding, mechanical connectors, full encirclement sieves, flexible pipe repair. | 8 | 15 |
| **Total** | 48 | 75 |

Term Work Assignments:

1. Rotary drilling rig and its components

Power system -Hoisting system -Rotating system –Circulating system -Well-controlled equipment, Auxiliaries

2. Preparing the layout drawings of different offshore platforms.

References books:


1. Ben. C. Gerwick Jr. Construction of marine and offshore structures, A Wiley Interscience publications , John Wiley & Sons, New York Chichester Brishare, Toronto, Singapore.
2. F.L.L. B Carneiro, Offshore Structures Engg-I, Gulf Publishing Co. Book Division, Houston, London, Paris, Tokyo.
3. F.L.L. B Carneiro, Offshore Structures Engg-II, Gulf Publishing Co. Book Division, Houston, London, Paris, Tokyo.
4. Charkrabarti, S. K. 1987, Hydrodynamics of offshore structures, Coputational Mechanics Publications, Southampton, Boston, 440p
5. Dawson, T.H, 1983, Offshore structural engineering, Prentice Hall Inc., Englewood Cliffs, new Jersey, 346p
6. DNV, 1977, Rules for the design construction and inspection of offshore structures, Det Norske Ventas, Norway, 67p
7. Graff, W. J., 1981, Introduction to offshore structures: Design, fabrication, Installation., Gulf Publishing Company, Honston, USA, 345 p
8. Khurmi, R.S 1983, A textbook of Applied Mechanics, S.Chand & Company, New Delhi, 699p
9. Mousselli, A.h, 1981 Offshore pipeline design, analysis and methods, Penn well Books, Pennwell publishing Company, Oklahoma, 193 p.
10. Poulos, H.G., 1988, Marine Geotechnics, Unwin Hyman, London, UK, 473p

## (IE6**) INSTIUTIONAL ELECTIVE

### 1. RATIONALE :

It has been observed that the curriculum prescribed, is many times out of context of Industry, on account of the pace with which technology development is taking place at Industry end. Due to this, gap exists between the Industry requirement of manpower and manpower produced by the Polytechnics. Board takes some time to incorporate the development of technology in the curriculum and many a times technology becomes outdated when it is incorporated in the curriculum. Further the expertise to train students as per Industry current requirement is available at the institute, but the same cannot be taught to students, as it is not a part of curriculum.

To address this situation, Board has decided to permit Institutions affiliated to Board, to identify such technologies or other aspects and teach the same to the students as an elective subject called "Institutional Elective". Through this Institutional Elective subject, Institutions will be able to cater to the requirements of Industry by identifying their immediate requirement and prepare the students for the requirement by developing the curriculum in consultation with the Industry.

As many a time's same subject may not be offered more than one or two years, a non conventional way of teaching – learning may be required to be adopted. Participation of Industry experts, guest lecturers, visit to Industry, exploring the knowledge available on net, etc may be essential to achieve the objectives.

### 2. TEACHING AND EXAMINATION SCHEME :

| Course code & course title | Periods/Week (in hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory | | Practical | | Total Marks |
| IE6** INSTIUTIONAL ELECTIVE | L | T | P | C | TH | TM | PR/OR | TW | 150 |
| | 3 | - | 2 | 5 | 75 | 25 | 25 | 25 | |

### 3. DETAILED COURSE CONTENTS :

a) Curriculum shall be drafted by the concerned department by interacting with Industry counterpart in regards to the Newer Technology required to be transferred for purpose of Teaching /Learning process.

b) Department shall work out the modalities of execution of the curriculum at Industry/Institute Level.

c) Curriculum shall be forwarded to Board for approval before its implementation.

# (IE651) FIBER RE-INFORCED POLYMERS

**RATIONALE**: Fibre reinforced polymers (FRP) are composites used in almost every type of advanced engineering structure, with their usage ranging from aircraft, helicopters, spacecraft, boats, ships, offshore platforms, automobiles, sports goods, chemical processing equipment and civil infrastructure such as bridges and buildings. FRP composites are lightweight, noncorrosive, exhibit high specific strength and specific stiffness, are easily constructed and can be tailored to satisfy performance requirements. It is observed that there is a shortage of trained manpower to cater to the needs of ever growing FRP industry. The course is structured to provide adequate technical knowledge about FRP that includes types of matrix resins and reinforcements, various processing and post processing methods, various kinds of inspection tests on raw materials and
finished products, repair techniques, handling and safety in FRP manufacture.

| Course Code & Course Title | Lectures/ Week (In Hours) | | | Total Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Marks | | Practical Marks | | Total Marks |
| **IE 651** | **L** | **T** | **P** | **C** | **TH** | **TM** | **PR/OR** | **TW** | |
| **Fiber Reinforced Polymers** | 3 | - | 2 | 5 | 75 | 25 | 25 | 25 | **150** |

*Minimum passing percentage : Theory 40% and Practical 40%* *Duration of Theory Paper: 3 Hrs.*

COURSE CONTENT:

1.0 Introduction to composites
- 1.1 Definition of composites
- 1.2 Constituent phases
- 1.3 Classification of composites
- 1.4 Types of matrices and reinforcements
- 1.5 General characteristics of fiber reinforced composites
- 1.6 Fiber reinforced polymer composites
- 1.7 Main features, benefits and drawbacks of composites
- 1.8 Applications of FRP in various industries.

2.0 Fiber reinforcements
- 2.1 Types of fibers and their development
  - 2.1.1 Organic fibers
  - 2.1.2 Glass fibers
  - 2.1.3 Boron fibers

2.1.4 Silicon fibers
2.1.5 Carbon fibers
2.1.6 SiC based fibers
2.1.7 Continuous mono-crystalline filaments
2.1.8 Whiskers
2.1.9 Kevlar fibers.

2.2 Fiber surface treatments for glass fibers, carbon fibers, kevlar fibers.

3.0 Organic matrices

3.1Introduction
3.2Resin structure
3.3Matrix mechanical behavior
3.4 Characteristics and applications of Thermosetting matrix systems
3.4.1 Unsaturated polyester resins
3.4.2 Vinyl ester resins
3.4.3 Epoxy resins
3.4.4 Phenolic resins
3.5 Characteristics and applications of Thermoplastic matrix materials.
3.6 Fillers and other additives
3.7 Accelerators, Promoters and catalysts.

4.0 Composite manufacturing processes

4.1 Introduction
4.2 Reinforcement shapes
4.3 Introduction to mould making
4.4 Resin matrix processes and associated tools, equipments and consumables
4.4.1 Contact molding
4.4.2 Spray up molding
4.4.3 Bag molding and autoclaving
4.4.4 Resin transfer molding
4.4.5 Vacuum molding
4.4.6 Vacuum assisted resin injection/transfer cold press molding
4.4.7 Hot press molding
4.4.8 Injection molding
4.4.9 Rotational molding
4.4.10 Centrifugal casting
4.4.11 Filament winding
4.4.12 Pultrusion
4.4.13 Compression molding
4.4.14 Sandwich construction
4.5 Prepegs and sheet molding compounds (SMC)

5 Post processing methods

5.1 Introduction
5.2 Various post processing methods
5.2.1 Cutting
5.2.2 Trimming
5.2.3 Machining
5.2.4 Joining

5.2.4.1 Mechanical fastening
5.2.4.2 Adhesive bonding
5.2.4.3 Lamination
5.2.5 Painting and coating

6 Inspection and quality control
6.1 Raw material inspection tests
6.1.1 Resin gel time
6.1.2 Resin viscosity
6.1.3 Resin peak exotherm temperature
6.1.4 Resin and hardener refractive index test
6.1.5 Fiber average density
6.1.6 Fiber moisture content
6.1.7 Fiber binder content
6.2 Tests on finished composites
6.2.1 Non destructive tests
6.2.1.1 Visual
6.2.1.2 Tap test
6.2.1.3 Ultrasonic methods
6.2.1.4 X-ray imaging
6.2.1.5 Thermography
6.2.2.6 Barcol hardness test
6.2.2.7 Hydrostatic tests
6.2.2 Other destructive tests
6.2.2.1 Loss on ignition test- to calculate resin and reinforcement percentage.
6.2.2.2 Glass transition temperature test – to verify curing of composite
6.2.2.3 Pipe burst test.
6.2.2.4 Fire endurance test

7.0 Design criteria in FRP product manufacture
7.1 Factors influencing design
7.2 Selection of raw materials
7.3 Selection of processes.

8.0 Repair and maintenance of FRP components
8.1 Tools and materials required.
8.2 Identification of defects as per required standard. eg ISO 14692
8.3 Repair procedure for superficial damage – external and internal
8.4 Major damage – Reject or repair as per manufacturer's recommendation.

9.0 Handling, disposal and safety in FRP manufacture
9.1 Precautions in handling raw materials and finished products.
9.1 Disposal of wastes developed during manufacture of FRP
9.3 Safety precautions during FRP manufacture

List of Practicals:

1. Identification of tools used in FRP repair and in fabrication.
2. Safety precautions and procedures associated with FRP.
3. Identify different resins and reinforcement fibers used in FRP manufacture.
4. Fabricate a panel using hand layup technique.
5. Fabricate a panel using vacuum assisted resin injection.
6. Fabricate a component using bag moulding and autoclave.
7. Carry out a glass fiber skin repair job.
8. Carry out an edge repair to a glass fiber panel.
9. Explain the procedure for recording a FRP repair.

Suggested specifications table with hours and marks:

| Unit No. | Topic | Teaching hours per Semester | Total marks |
|---|---|---|---|
| 1.0 | Introduction to composites | 05 | 09 |
| 2.0 | Fiber reinforcements | 06 | 09 |
| 3.0 | Organic matrices | 06 | 09 |
| 4.0 | Composite manufacturing processes | 10 | 15 |
| 5.0 | Post processing methods | 04 | 06 |
| 6.0 | Inspection and quality control | 05 | 09 |
| 7.0 | Design criteria | 05 | 09 |
| 8.0 | Repair and maintenance of FRP components | 03 | 03 |
| 9.0 | Handling. Disposal and safety in FRP manufacture | 04 | 06 |

List of Text books:

Composite materials: Engineering and science by F.L. Matthews and D. Rawlings, Woodhead Publishing Ltd Cambridge, England

G Lubin, “Hand Book of Composites”, 2nd Ed, Van Nostrand Reinhold, New York, 1982.

L.Holloway “Hand Book of Composites for Engineers”, Technomic, Lancaster, Pa, 1994.

Composite materials: Science and Engineering by Krishan K. Chawla, Springer

List of Reference books

[1] S.M. Lee, “Dictionary of Composites Materials Technology”, Technomic Lancaster, Pa, 1989.

[2] G.Shook, “Reinforced Plastic for Commercial Composites”, Source Book, Asm,1986.

[3] Kevin Potter, "An Introduction to Composites Products", Chapman and Hall Madras India 1997.

[4] S.T.Peter, "Hand Book of Composites", Chapman and Hall Chennai 1998.

[5] Lin / Pearce, "High Performance Thermosets", Hanser Publishers, Munich, NewYork, 1993.

[6] Harold Belofsky, "Plastics: Product Design And Process Engineering", Hansen Publisher Munich, New York, 1995,

[7] Introduction to Material Science for Engineers by James F. Shackelford and Madanapalli K. Muralidhara, Pearson

[8] Engineerng Materials by A.K. Bhargava , Eastern Economy Edition

# SEMESTER VIII

## (SH801) INPLANT TRAINING PHASE II

### 1. RATIONALE:-

The objective of the training is to correlate theory and practice and make the students employable in industry. Through training the students will be able to get hands on experience in the various job activities associated with ship construction, ship repair and obtain practical knowledge and experience in the installation, operation and maintenance of marine machinery. The infrastructure, equipment and practices of the ship building industry is unique and the training would enable the students to acquaint themselves with these and relate them to the theory learnt. The students will be exposed to industrial environment, obtain experience in working under factory discipline, associate with workers and understand their psychology and work habits.

### 2. TEACHING AND EXAMINATION SCHEME:

| Course code | Name of Course | EXAMINATION SCHEME | | | | Total |
|---|---|---|---|---|---|---|
| | | TW | | PR/OR | | |
| | | Daily Diary | Progressive Assessment | Training Report | Report Assessment & Seminar/ Viva | |
| SH801 | Inplant Training Phase II | 50 | 50 | 50 | 50 | Grade |

*** Grade: The trainees will be awarded a grade as mentioned in column 5.**

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The training imparted through this course should be such that the theory learned during first 7 semesters of Shipbuilding Engineering can be linked with the Industrial practices and the outcome of the inplant training should aid in enhancing students employability in industry.

## *4.* COURSE CONTENTS

| |
|---|
| **Unit 1 Shipyard practices**<br><br>Material estimation, work scheduling, material planning, material procurement, project management, quality control, compliance with statutory requirements and classification society. |
| **Unit 2 Fabrication**<br><br>Stockyard, steel preparation operation, management, CNC steel cutting operation, marking system of plates, assembly, recording of weights. |
| **Unit 3 Out-fitting**<br><br>Engine Room machinery installation and alignment, commissioning of machinery and machinery trials. Deck machinery installation, commissioning and trials. |
| **Unit 4 Launching**<br><br>Launching calculation, preparation for launching, pre-launching checks, precaution at launching & launching ceremonies, types of launching, their advantages and disadvantages. |
| **Unit 5 Ship repair**<br><br>Survey of hull, renewal of wasted areas, preparation of templates, welding procedures. Propeller, rudder and shaft survey, repair procedure. Machinery removal and replacement after repairs. Overhauling of pumps, pipe, valves, etc. |

**Daily dairy:** The students are required to maintain a daily diary as a day to day record of their attendance at the factory, indicating clearly the activities/jobs performed by them during the day. End of the training a questionnaire provided by department needs to be filled by students.

**Training Report:** Doing the daily diary, the students will prepare a report detailing all the jobs activities performed at the yard and in full detail the specific projects undertaken by them. The report will also cover the layout of the yard, facilities and infrastructure, types of ships under construction, etc. The report is to be in typed format complete with illustrations and drawings.
Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

1. For Industrial training of V$^{th}$ & VIII$^{th}$ Semester Grades will be awarded based on marks scored as follows:

80% and above Marks – Grade 'A'
60% to 79% Marks – Grade 'B'
40% to 59% Marks – Grade 'C'
Marks below 40% - Grade 'D'

2. TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade 'C' for passing.