Nepal Engineering Council Registration Examination

B. TECH. IN NAVAL ARCHITECTURE & SHIP BUILDING SYLLABUS (ASbE)

1. BASICS OF ENGINEERING (ASbE01)

1.1. Engineering Drawing**:** Projections, Orthographic drawings, Isometric views, Missing lines and views, Sectional views and conventional practices, Auxiliary views, Assembly drawings. (ASbE0101)

1.2. Workshop Technology: Hand Working Operations, Drills and Drilling Processes, Machine Tools (Engine Lathes, Shapers, Milling Machines, Grinding Machines), Foundry and Forging Practice, Metal Joining (Soldering, Brazing, Welding – Gas Welding, Arc Welding, Resistance Welding, Tungsten Inert Gas Welding (TIG), Metal Inert Gas Welding (MIG)) (ASbE0102)

1.3. Basic Electrical Engineering-I**:** Direct Current: Theorems of electric circuit, electrical network analysis, measuring instruments. Alternating current: AC quantities and waveforms, phasor algebra, AC circuit analysis, three phase circuits. (ASbE0103)

1.4. Basic Electrical Engineering-II: Transformers: Single phase and three phase, auto transformer. Fundamentals of DC generators, DC motors: principle and operation. (ASbE0104)

1.5. Electronic Technology for Marine Engineers-I Three phase induction motors. AC generators, synchronous motor, speed control of three phase motors. (ASbE0105)

1.6. Electronic Technology for Marine Engineers-II Diodes, BJTs, diode and BJT circuits, MOSFET and SCR as power switching devices, controlled rectifiers and inverters. Radar and wireless equipment, electronic navigation aids, LORAN, RDF and Decca Chain. (ASbE0106)

2. BASIC THERMAL ENGINEERING AND HEAT TRANSFER (ASbE02)

2.1. Fundamental concepts of thermodynamics, it's laws and their corollaries, Non flow process and flow processes. (ASbE0201)

2.2. Thermodynamic cycles and processes, Properties of pure substances, Mixture of gas and vapor, (ASbE0202)

2.3. Internal combustion engines: Petrol engines, Diesel engines and Gas turbines with their cycles and accessories, Steam generation units with accessories and mountings, Steam turbine. (ASbE0203)

2.4. Introduction: steady and unsteady state conduction in one dimension: cases of single and composite walls, cylinders and spheres, fins of uniform cross section. Transient heat transfer: system with negligible internal resistance. Introduction to two and three dimensional heat conduction. (ASbE0204)

2.5. Convection: forced and natural, basic mechanism, methods of evaluation, non-dimensional parameters, empirical and semi-empirical methods. Radiation: fundamental laws, black and gray bodies, form factors, evaluation of form factors. (ASbE0205)

2.6. Heat exchangers: parallel flow and counter flow. LMTD relationship. Heat transfer cases in ship design: insulation in bulkheads, refrigerated spaces, fish holds in trawlers. (ASbE0206)

3. FLUID MECHANICS AND HYDROSTATICS STABILITY (ASbE 03)

3.1. Fluid properties, fluid statics and kinematics, continuity, energy and momentum principles, energy and hydraulic grade-lines, laminar and turbulent flows, introduction to boundary layers, drags, and wakes, friction and flow through pipes, impact of jets. (ASbE0301)

3.2. Dimensional analysis, principles of similitude and model testing, Aerofoil and its application. (ASbE0302)

3.3. Hydraulic machines: turbines and pumps. (ASbE0303)

3.4. Hull form definition of ships and ocean structures. Lightweight, deadweight, capacity and tonnage measurement. Hydrostatic calculations. (ASbE0304)

3.5. Initial stability, free surface effects, stability at large angles, intact stability computations, damaged stability and its calculations by lost buoyancy and added weight method. Inclining experiment. (ASbE0305)

3.6. International Maritime Organization (IMO) stability criteria, wind heel criteria. Subdivision and floodable length calculations. Subdivision indices. Launching calculations. (ASbE0306)

4. MECHANICS OF STRUCTURE AND THEORY OF MACHINES (ASbE04)

4.1. Fundamental of stress analysis. Mechanical properties of materials. Normal, shear and combined stresses. (ASbE0401)

4.2. Joint and beam analyses: continuous beam, beam on elastic foundation, curved beam. Column and buckling analyses. (ASbE0402)

4.3. Thick cylinder and pressure vessel. Torsion and shaft design. Theories of failure. (ASbE0403)

4.4. Kinematics and Kinetics of motion. Simple harmonic motion. Simple mechanism. Velocity in mechanisms (instantaneous center methods and relative velocity method). Accelerations in mechanisms. Mechanisms with lower pairs. (ASbE0404)

4.5. Friction. Belt, rope and chain drive. Toothed gearing. Gear trains. (ASbE0405)

4.6. Gyroscopic couple and precision motion. Design of marine shafts, stern tube and bearing. (ASbE0406)

5. SHIPBUILDING MATERIALS AND COMPUTER AIDED DESIGN (CAD) (ASbE05)

5.1. Metals as materials of construction; Industrially significant properties of metallic materials; Production, properties and uses of Pig Iron, Cast Iron and Carbon Steels. (ASbE0501)

5.2. Nonferrous alloys; Protective Coatings; Ferrous alloys: Plain carbon, alloy, tool, stainless, heat-resisting and creep-resisting steels etc. (ASbE0502)

5.3. The Fe-Fe_3C equilibrium; Different types of heat treatment operations; Case hardening of steels, Cement, Ferro-cement, Timber, Rubber, Glass and Plastics. (ASbE0503)

5.4. Introduction to CAD. Drawing unit and scale, 2-D drawing tools, modification tools, layers, hatching and dimensioning. (ASbE0504)

5.5. Working in 3-D space, 3-D coordinate systems, drawing sheet layout, viewpoints, 3-D drawing tools, 3-D wire frame modeling, surface modeling, solid modeling and rendering. (ASbE0505)

5.6. Application of CAD in ship design. Introduction to computer aided manufacture (CAM). (ASbE0506)

6. MARINE HYDRODYNAMICS RESISTANCE AND PROPULSION OF SHIPS (ASbE06)

6.1. Flow of an ideal fluid: equation of continuity, streamlines, streak lines and path lines, two-dimensional flow patterns, rotational and irrotational flows, vorticity, velocity potential functions, stream functions, Euler's equation of motion, Bernoulli's equation, velocity and pressure distribution. (ASbE0601)

6.2. Uniform flow, irrotational vortex, circulation, source, sink and doublet, flow past a half body, cylinder and rankine body, virtual mass and Magnus effect. Conformal transformation: analytic functions, singularities, Cauchy-Riemann equations, complex potential, application of conformal transformation to some flow cases, Joukowski's hypothesis, lift of an infinite aerofoil. (ASbE0602)

6.3. Theorems of Green, Stokes, Cauchy and Blasius and their application to some hydrodynamic problems. Flow of a real fluid: Navier-Stokes equations, displacement, momentum and energy thickness of the boundary layer, and characteristics of flow around a ship hull. (ASbE0603)

6.4. Phenomena resisting the motion of ships. Resistance due to friction, wave making, form, appendage, wind and waves, squat, blockage and shallow water effects. Estimation of powering using methodical series and statistical methods. (ASbE0604)

6.5. Advantageous effects of hull form changes- bulbous bows. Asymmetric sterns and optimum trim for ships in ballast. Screw propeller geometry. Momentum and blade element theories. Propellers in open water, propeller coefficients and design charts. (ASbE0605)

6.6. Hull propeller interaction- wake, thrust deduction and relative rotative efficiency. Propeller cavitations. Propeller blade strength. Screw design according to circulation theory for uniform and non-uniform wake. Speed trials and service performance analysis. (ASbE0606)

7. SHIPBUILDING TECHNOLOGY (ASbE07)

7.1. Development of ship welding. Different types of welding and their equipment. Welding principle, types of power sources and their characteristics. (ASbE0701)

7.2. Welding methods in ship technology: MMAW, GMAW, SAW, Electro-slag welding, TIG. (ASbE0702)

7.3. Types of welding joints. Welding symbols. (ASbE0703)

7.4. Welding sequence in shipbuilding, Common defects in ship welding: welding distortion monitoring and control, inspection and testing of welded specimen. (ASbE0704)

7.5. Non destructive testing. Methods and principles of cutting, cutting equipment. (ASbE0705)

7.6. Steel surface preparation – shot blasting, acid pickling, etc. (ASbE0706)

8. Design of Marine Vehicles AND Ship Structure (ASbE08)

8.1. Engineering design-philosophy. Various design stages: concept design, basic designs, preliminary designs, contract designs, detailed designs. (ASbE0801)

8.2. Design spiral: cargo routes, estimation of dimensions and hull form and displacement, preliminary G. A. plan, calculation of freeboard, depth and volume. (ASbE0802)

8.3. Calculation of longitudinal strength and powering, selection of machinery and outfit, checking for trim and stability, estimation of lightweight and cargo deadweight, economic criteria and evaluation. Case studies of typical marine vehicles. (ASbE0803)

8.4. Forces on the ship. Ship strength calculation, longitudinal and transverse strength of ship. (ASbE0804)

8.5. Dynamic effects. Structural discontinuities, stress concentration, superstructure theory. (ASbE0805)

8.6. Plate and shell analyses: grillages, buckling of plates. Composite construction. Introduction to Finite Element Methods (FEM). (ASbE0806)

9. MARINE ENGINES AND FUELS (ASbE09)

9.1. Performance study of internal combustion engines. Fuels and combustion. Internal combustion engine systems: introduction, fuel oil, injection, intake, exhaust etc. (ASbE0901)

9.2. Engine components: crankshaft, bearings, connecting rod, piston, liner, ring, thrust bearing etc. (ASbE0902)

9.3. Marine fuel: types, grading, testing, treatment methods, blending, catalytic cracking etc. HSD, IFO and heavy fuel engines. (ASbE0903)

9.4. Gas turbines. Nuclear power plants. Introduction to combustion chamber: open and divided, combustion chamber in marine diesel engines. (ASbE0904)

9.5. Turbo-charging: thermodynamics, principle, types and design limitations. Vessel type and engine choice. (ASbE0905)

9.6. Study of sources of energy, introduction to renewable energy sources. (ASbE0906)

Project Planning, Design and Implementation (AALL10)

10.1 Engineering drawings and its concepts: Fundamentals of standard drawing sheets, dimensions, scale, line diagram, orthographic projection, isometric projection/view, pictorial views, and sectional drawing. (AALL1001)

10.2 Engineering Economics: understanding of project cash flow; discount rate, interest and time value of money; basic methodologies for engineering economics analysis (Discounted Payback Period, NPV, IRR & MARR); comparison of alternatives, depreciation system and taxation system in Nepal. (AALL1002)

10.3 Project planning and scheduling: project classifications; project life cycle phases; project planning process; project scheduling (bar chart, CPM, PERT); resources levelling and smoothing; monitoring/evaluation/controlling. (AALL1003)

10.4 Project management: Information system; project risk analysis and management; project financing, tender and its process, and contract management. (AALL1004)

10.5 Engineering professional practice: Environment and society; professional ethics; regulatory environment; contemporary issues/problems in engineering; occupational health and safety; roles/responsibilities of Nepal Engineers Association (NEA). (AALL1005)

10.6 Engineering Regulatory Body: Nepal Engineering Council (Acts & Regulations). (AALL1006)