

## D4 PIPING ENGINEERING

SEMESTER I				SEMESTER II			
NO.	COURSES	CREDIT	TOTAL HOURS	NO.	COURSES	CREDIT	TOTAL HOURS
1	Indonesian Language	2	2	1	Mathematics II	2	4
2	English I	3	3	2	Physics II	2	4
3	Mathematics I	2	4	3	Fluids Mechanic	2	4
4	Physics I	2	4	4	Thermodynamics	2	4
5	Piping Technology	1	2	5	Ship Propulsion	2	4
6	Engineering Mechanics	1	2	6	Isometric Image	3	6
7	Theory of Shipbuilding	3	6	7	Pneumatics and Hydraulics	3	6
8	Mechanical Technology	3	6	8	Entrepreneurship	2	4
9	Engineering Drawing	2	4				
10	Computer-Aided Design Practice	2	4				
<b>TOTAL</b>		21	37	<b>TOTAL</b>		18	36

  

SEMESTER III				SEMESTER IV			
NO.	COURSES	CREDIT	TOTAL HOURS	NO.	COURSES	CREDIT	TOTAL HOURS
1	Chemistry	1	2	1	English II	2	2
2	Materials Science	3	6	2	Automatic Control Systems	3	6
3	Codes and Standards of Piping System	1	2	3	Advanced Piping Drawing	3	6
4	In-Ships System	2	4	4	Sanitary Drainage System	3	6
5	Pumps and Compressors	4	8	6	Fabrication of Piping and Air Duct	3	6
6	Technique of Welding and Fabrication	3	6	7	Clean Water Pipeline Systems	3	6
7	Refrigeration (HVAC)	3	6	8	Steam Generator Systems	2	4
8	Advanced Mechanical Technology	2	4				
<b>TOTAL</b>		19	38	<b>TOTAL</b>		19	36

SEMESTER I				SEMESTER VI			
NO.	COURSES	CREDIT	TOTAL HOURS	NO.	COURSES	CREDIT	TOTAL HOURS
1	Indonesian Values and Ideology	2	2	1	Research Methodology	1	2
2	Tanker Piping Systems	4	8	2	Design of Pressure Vessel & Steam Aircraft	3	6
3	Waste Treatment Systems	2	4	3	Foundations and Pipe Laying*)	2	4
4	Thermal Piping Design	2	4	4	DFKI-Tank & Pipe	3	6
5	Engineering Economics	1	2	5	Petroleum Exploration Systems	2	4
6	Processing Technology	3	6	6	Modeling of Piping Systems	3	6
7	Safety on Pipes, Pressure Vessel and Steam Power Plan	2	4	7	Design of in-Ships piping system	4	8
8	Project Management	1	2	8	Firefighting System	2	4
9	Reliability	2	4				
10	Occupational Health and Safety	1	2				
<b>TOTAL</b>		20	38	<b>TOTAL</b>		20	40

  

SEMESTER VII				SEMESTER VIII			
NO.	COURSES	CREDIT	TOTAL HOURS	NO.	COURSES	CREDIT	TOTAL HOURS
1	On The Job Training (OJT)	18	40	1	Religious Study	2	2
				2	Advanced English	3	3
				3	Capita Selecta	2	4
				4	Piping Systems Design	4	8
				5	Project Work	6	12
<b>JUMLAH</b>		18	40	<b>JUMLAH</b>		17	29

NO.	COURSE TITLE	CREDITS/ HOURS	COURSE DESCRIPTION
1.	Indonesian Language	2	<p><b>Objectives:</b> Students are able to prepare technical reports and write scientific articles using Indonesian Language Standard.</p> <p><b>Course Topics:</b> a. Writing a technical report includes definition, purpose, type of writing, and straightforward language b. Create a scientific writing includes definition, elements in writing and language style.</p> <p><b>References:</b> [1]. Arifin, E. Zaenal, <i>Bahasa yang Lugas dalam Laporan Teknis</i>, Jakarta, Akademika Pressindo, 1993. [2]. Gorys Keraf, Prof. Dr, <i>Tata Bahasa Indonesia</i>, Cetakan XV, Penerbit Nusa Indah, 1996.</p>
2.	English I	3	<p><b>Objectives:</b> Students can comprehend a simple English discourse in the field of engineering .</p> <p><b>Course Topics:</b> Daily conversation, describing object based on number, size, shape, number, colors, and characteristic, responding information, make a conclusion, write a simple command, filling out a form</p> <p><b>References:</b> [1]. <i>English for Maritime Studies</i> by TN Blakey.</p>

- [2]. *English for computer science* by Norma D. Mullend P. Charles Brown.  
 [3]. *Question and Answer*, Graded Oral Comperehensive Exercise by L.G.Alexander.  
 [4]. *Practice and Progress* by .L.G. Alexander

3.	Mathematics I		<p><b>Objectives:</b>          Provide a basic understanding of mathematics associated with applications in the fields of engineering. Students are able to perform mathematical calculations on technical applications.</p> <p><b>Course Topics:</b>          The material taught is the determinant, matrix algebra, vectors, basic calculus, complex numbers, differential and integral.</p> <p><b>References:</b>          [1]. Diktat Kuliah Matematika I, II, FMIPA ITS.          [2]. Bird, J.O and A.J.C. May echnicians, Longman Scientific &amp; Technical, 1978.          [3]. Stroud, K.A, Matematika untuk Teknik, Penerbit Erlangga, 1995.          [4]. Baisuni,H.M.H, Kalkulus, UI Press, 1986.          [5]. in, J.R, Essensials of Applied Mathematics, Edward Arnold Ltd., 1986</p>
4.	Physics I	1/2	<p><b>Objectives:</b>          To discuss the basic laws of physics through simple mathematical description, as well as introducing the concept.</p> <p><b>Course Topics:</b>          Vector, velocity and acceleration, straight and curved motion, Newton's Laws, Force: friction, centripetal, work, kinetic energy and gravitational potential energy, Center Mass, Momentum and angle rigid body, stiff body balancing, vibration and submerged in harmony, elasticity, hydrostatic , Fluid Dynamics, Heat Transfer, Thermodynamics, Law I and II, ideal cycles in gases and vapors.</p> <p><b>References:</b>          [1] Halliday and resnick, fundamental of Phisics.          [2] Alonso and finn, Fundamental University Phisics, Vol I.          [3] Dosen FMIPA ITS, Diklat Fisika I</p>
5.	Introduction to Piping Engineering	1/2	<p><b>Objectives:</b>          This lecture will introduce piping and fitting's concept and techniques. Including the use of materials, measuring, cutting, merging techniques of various pipes with different material, the use of hanger and support on various types of pipe, including steel pipe, plastic, copper, cast pipes with or without a connection. Assessing piping system to drain, vents, traps, fittings. Providing basic knowledge to students about the function and application of piping systems in workplace. The introduction of standards and quality work of piping systems, such as ships, offshore production platforms or existing piping systems in industry. Introduction of common procedures of piping work inspection and the introduction of several standards related to some piping work.</p> <p><b>Course Topics:</b></p> <ul style="list-style-type: none"> <li>- Piping Components</li> <li>- Piping Materials</li> <li>- Piping Codes And Standards</li> <li>- Manufacturing Of Metallic Pipe</li> <li>- Fabrication And Installation Of Piping Systems</li> <li>- Bolted Joints</li> <li>- Prestressed Concrete Cylinder Pipe (Pccp) And Fittings</li> <li>- Grooved And Pressfit Piping Systems</li> </ul> <p><b>References:</b>          [1]. Nayyar, Mohinder L. Nayyar, Reno C. King, and Sabin Crocker, <i>Piping Handbook</i>, Mc Graw – Hill</p>

- [2]. Grinnell, *Piping Design and Engineering, 5th edition*, ITT Grinnell Industrial Piping, 1975
- [3]. Michael Frankel, *Facility Piping Systems Handbook, 2 Edition*, McGraw-Hill Professional, 2001

**6. Mechanical Technology**

**Objectives:**

- Students can comprehend the operation of the system tooling machines are precise, accurate and efficient.
- Students can comprehend how measurement tools, work bench equipment and machine tools

**Course Topics:**

Accurate measurement, Lay Out, Working Benches, Sheet Metal, Metal Flake and Oil Lubricants, Drilling Press, Chainsaws, Bout Machine, Trim Engine, Sclop machine, grinding machine.

Measuring: steel ruler, calipers, micrometers, scraping, drip, stamping, flat honing, inside and outside honing, sawing, drilling, tapping, surface lathe, cylinder lathe, flat grinding, flat scrapping.

**References:**

- [1] Heinrich, G, *All About Machine Tools*, Wiley eastern Ltd, 1965.
- [2] Vidosic, J.P, *Metal machinean forming tecnology*, The ronald Press Co.
- [3] Surdiat dan shinroku S, *Pengetahuan Bahan Bahan Teknik*, PT Pradnya Paramita, Jakarta, 1985.
- [4] Dieter, *Mechanical Metallurgy*, McGraw Hill New York 1986.
- [5] Wiley,J, *Fibreglass Repair & Constr Handbook*, 1982.
- [6] Central Machine tool, Institute Bangalone, *Machine Ted Design Handbook*, Tata Mc-Graw-Hill Publishing Co,Ltd 1982.
- [7] Chapman , W.A.J, *Senior Work Calculations*, 3 rd ed, Edward Arnold.

**7. Engineering Drawing**

**Objectives:**

Students can create and read working drawings planning in accordance with the rules of normalization/classification as well as create the image as particulars accurately and objectively.

**Course Topics:**

Introduction; Geometrical Construction, Presentation of three-dimensional objects, projection methods used on working drawings, basic ways to present the images, the ways to give standard size, giving the size of the parts Similarly, composition of the standard size, giving size of arranged parts, how shading image. Pieces/slices, Landscape/ openings, methods of appointment of the surface roughness, pointer screw, tolerance and fits (task).

**References:**

- [1]. Sato GT dan Hartanto NS, *Menggambar Mesin Menurut Standar ISO*, PT. Pradnya Paramita, Jakarta 1983.
- [2]. Luzader JW dan Hendrasin H, *Menggambar Teknik untuk Disain, Pengembangan Produk dan Kontrol Numerik*, Erlangga, Jakarta, Edisi ke 8, 1986.
- [3]. Hey La et al, *Ilmu Menggambar Bangunan Mesin*, Buku Teknik Starn, Jakarta, 1952

**8. Shipbuilding Theory**

**Objectives:**

Students are able to understand the criteria for designing a ship. To comprehend geometry and size of the main vessel. Understanding the concept of structural strength, floatation, trim and stability of the vessel.

**Course Topics:**

Principal Dimension, geometry and size of the main vessel, Safety Issues. Power structure. Floating style, Ship Stability and Trim, Symbol and Nomenclature, Ship Girder

**References:**

- [1]. KJ Rawson, E. C. Tupper, *Basic Ship Theory Vol. 1, 5 edition*, Butterworth-Heinemann, 2001.
- [2]. Thomas C Gillmer, Bruce Johnson, *Introduction to Naval Architecture*, 2nd print, Naval Institute Press, 1982.

9.	Engineering Mechanics	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• Improve knowledge of vector and sum of vector</li> <li>• Comprehend the concept of equilibrium in a system of concurrent and non-concurrent force within a 2 and 3-dimension.</li> <li>• Study the mathematical and physical relationships between forces and moments.</li> <li>• Learn about the development and the use of free - body diagrams in solving problems of solid mechanics.</li> <li>• Learn how to complete the application of the concept of equilibrium in the structure of the building (eg; support and order)</li> <li>• Studying the calculation of the mass and geometry of objects.</li> <li>• Comprehend the concept of dry friction and study the issues include the static friction.</li> </ul> <p><b>Course Topics:</b></p> <p>Concurrent Force Systems</p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Vectors</li> <li>• Forces</li> </ul> <p>Non-Concurrent Force Systems</p> <ul style="list-style-type: none"> <li>• Systems of Forces and Moments</li> <li>• Objects in Equilibrium</li> </ul> <p>Trusses, Frames and Machines</p> <ul style="list-style-type: none"> <li>• Structures in Equilibrium</li> </ul> <p>Geometric Properties of Shapes</p> <ul style="list-style-type: none"> <li>• Centroids and Centers of Mass</li> <li>• Moments of Inertia</li> </ul> <p>Friction</p> <p><b>References:</b></p> <p>[1] Popov,EP, "Mechanics Of Material "Prentice Hall,Inc, 1976.  [2] Timosenko, SF and Young DH,"Elements Of Strength Of Material," 5th. edition, Van Nostrandamaruzzen, 1968.  [3] William a Nash, "Strength Of Material." Schanm"s Series, Mc Graw Hill, 1971.</p>
10.	CADD	<p><b>Objectives:</b></p> <p>Introduction to depiction process piping systems with CAD. Emphasis on image creation, modification measure, store and display the file. Defining the forms of pipes with CAD, placing, rotating, scaling drawing objects, add text, dimensions, using layers, coordinate systems.</p> <p><b>Course Topics:</b></p> <p>Introduction of CAD system  Create and manage image files (DWG, DXF).  Equipment and supplies CAD systems  Setting CAD system  Depiction and Scale.  Polygon, Donut, Ellipse, Rectang, Polyline. Grip  Edit Tools  Construction Technique with AutoCAD  Text and Command Dtext  Introduction to Block  Introduction and Preparation to Dimension  Hatching and Crosshatching  Hatch Boudary  Trace, Multiline, Multiline Edit. Printing and Plotting.  Introduction to Viewports.</p> <p><b>References:</b></p> <p>[1]. Sham Tickoo, <i>A Problem Solving Approach AutoCAD</i>, ITP.  [2]. Rip Weaver, <i>Process Pipe Drafting Workbook</i>, Gulf Publishing.  [3]. Louis Gary Lamit, <i>Piping Systems, Drafting and Design</i>, Prentice Hall,</p>

- [4]. Roy A. Parisher, Robert A. Rhea, *Pipe Drafting and Design, Second Edition, 2 edition*, Gulf Professional Publishing, 2001

11.	Mathematics II	<p><b>Objectives:</b> Students are able to apply basic math to other courses.</p> <p><b>Course Topics:</b></p> <ul style="list-style-type: none"> <li>• Integral Application Specific (area, volume, arc length, surface area of skin, in polar coordinates and the coordinates)</li> <li>• Central Mass</li> <li>• Moment of inertia</li> <li>• Fluid Pressure</li> <li>• Power</li> <li>• Numerical Integration</li> <li>• Front and line</li> <li>• Ordinary Differential Equations</li> </ul> <p><b>References:</b></p> <p>[1] <i>Diktat Kuliah Matematika I, II</i>, FMIPA ITS.  [2] Bird, J.O and A.J.C. May, <i>Technicians</i>, Longman Scientific &amp; Technical, 1978.  [3] Stroud, K.A, <i>Matematika untuk Teknik</i>, Penerbit Erlangga, 1995.  [4] Baisuni, H.M.H, <i>Kalkulus</i>, UI Press, 1986.  [5] Irwin, J.R, <i>Essentials of Applied Mathematics</i>, Edward Arnold Ltd., 1986</p>
12.	Physics II	<p><b>Objectives:</b> To discuss the fundamental laws of physics through simple mathematics description, as well as introducing the concept.</p> <p><b>Course Topics:</b> Electric Charge, Coulombs Law, Electric Fields, Gauss's Law, Electric Potential, Capacitance And Capacitors, Dielectrics, Electric Current, Induction and Magnetic Flux, Current Carrying Coil In A Magnetic Field, GGL Induction, Waves, Alternating Current, Optics, Atomic Structure, Nuclear Physics.</p> <p><b>References:</b></p> <p>[1] Halliday and Resnick, <i>Fundamental of Physics</i>.  [2] Alonso and Finn, <i>Fundamental University Physics</i>, Vol I.  [3] Lecturers in FMIPA ITS, <i>Diklat Fisika I</i></p>
13.	Fluid Mechanics	<p><b>Objectives:</b> Students are able to discern basic design of fluid machinery installation</p> <p><b>Course topics:</b></p> <ol style="list-style-type: none"> <li>1. Fluid Characterization</li> <li>2. Fluid Static</li> <li>3. Fluid Measurement</li> <li>4. Fluid Machinery</li> <li>5. Steady flow in the closed tunnel</li> <li>6. Flow in the open tunnel</li> <li>7. Dimensional analysis and dynamic equation</li> <li>8. Nil Fluid Flow</li> <li>9. Sink object forces</li> </ol> <p><b>References:</b></p> <p>[1] Steeter, V.L Benjamin E Wylie/ Mc Graw Hill, <i>fluid 1Mechanics/ Copy Right</i> 1981.  [2] Giles, V <i>Fluid Mechanics and Hydrolic</i>, 2nd ed, Mc Graw Hill 1977.  [3] Douglas J.F, <i>solving Problems in Fluid Mechanics</i>, Volume 1 &amp; 2 , Logman Scientific &amp; Technical 1986.  [4] F.m white Liek Wiharjo, <i>Mekanika Zalir</i>, Penerbit Erlangga 1986.  [5] W.P. Boyle, <i>Applied Fluid Mechanics</i>, McGrawHill Ryerson Ltd, 1986.</p>
14.	Thermodynamics	<p><b>Objectives:</b> Students are able to discern thermodynamic unit system,</p>

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thermodynamic laws, process cycle, heat transfer and its application in the engine and heat exchanger

**Course Topics:**

1. Thermodynamic unit system
2. Characterization of Thermodynamic substance
3. Energy and working concept
4. Thermodynamics law and its application
5. Ideal gas law and its characterization.
6. The application of thermodynamic concept at combustion engine, steam turbine, gas turbine, coolant engine, and heat pump
7. Heat transfer theory, conduction, convection and radiation
8. Heat exchanger

**References:**

- [1] William C Reynolds/ Henry C Perkins, *thermodinamika Teknik*, Terjemahan Filino Harahap, Erlangga Jakarta 1980.
- [2] Doolittle & hale, *Thermodynamic For Engineers*.
- [3] Jones & Howkins, *Engineering hermodynamic*

15.	Ship Propulsion	<p><b>Objectives:</b> Students are able to comprehend ship propulsion diesel engine and can determine main engine as ship propulsion engine.</p> <p><b>Course Topics:</b> Concept of ship propulsion system, engine duty cycle, construction and engine parts, factors of main engine, air filling, fuel, engine support systems, concepts and theories of machine selection.</p> <p><b>References:</b></p> <ol style="list-style-type: none"><li>1. Harrington R L, <i>Marine Engineering</i>, Sname, Jersey City, 1992</li><li>2. Illies.K, <i>Handbuch Der Schiffsbetriebstechnik</i>, Vieweg, 2 Auflage Teil 2, Braunschweig, 1984</li><li>3. Osbourne.A, <i>Modern Marine Engineer's Manual</i>, Vol. li, Second Edition, Cmp, Maryland, 1991</li><li>4. Paterson.W.B, <i>Red Book Of Marine Engineering</i>, Vol. li, Cmp, Maryland, 1990</li><li>5. Petrovsky.N, <i>Marine Internal Combustion Engine</i>, Mir Publisher, Moscow</li><li>6. Sperber.R, <i>Technisches Handbunh Dieselmotoren</i>. Web Verlag Technik, Berlin, 1986</li><li>7. <i>Project Guide</i> Dari Berbagai Marine Diesel</li></ol>
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16. Basic Piping Drafting

**Objective:**

To comprehend about pipe fittings, symbols, specifications, and applications in a piping process system. This application will be demonstrated through the creation and use of symbols in flow diagram, plan, elevations and isometric. After obtaining this course, students are expected to be able to;

- apply graphics, symbols as in ANSI, ASTM, ASME, and API to decide the dimensions and other data and apply it in a diagram of piping process.

**Course Topics:**

- Introduction to Piping Drafting
  - Pipe Data
  - Fittings
  - Flanges and Valves
  - Instrumentation and Process Flow Diagrams
  - Abbreviations And Specifications
  - Nomenclature for: Vessel, Structure, Foundation, and Electrical.
  - Equipment Laying
  - Plot Plan
  - Piping Standard Details
  - Plan and Pipeline Design Note
  - Picture Equipment Manufacturing
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- Plan, Elevation and Section
- Piping Support
- Isomers.

**References:**

- [1]. Rip Weaver., *Process Pipe Drafting Workbook*, Gulf Publishing.
- [2]. Louis Gary Lamit, *Piping Systems, Drafting and Design*, Prentice Hall, 2001
- [3]. Roy A. Parisher, Robert A. Rhea, *Pipe Drafting and Design*, Second Edition, 2 edition, Gulf Professional Publishing, 2001
- [4] Rayner Joel, *Basic Engineering Thermodynamics in SI Units*, 3 rd ed Longman Group Ltd, 1984.

17.	Hydraulic and Pneumatics	<p><b>Objectives:</b> To provide students basic knowledge of mechanical control systems that use air movers and oil media to control mechanisms - mechanisms in pneumatic machines and hydraulic machines.</p> <p><b>Course Topics:</b> Pneumatic's symbols; pneumatic elements and functions; basic pneumatic circuits; basic pneumatic and hydraulic; symbols pneumatic and hydraulic; pneumatic and hydraulic's element and functions.</p> <p><b>References:</b> [1] Ernset C. Fitch, <i>Fluid Power and Control System</i>, McGraw-Hill Book Company, New York, 1966. [2] Festo didactic, <i>Fundamentals of Pneumatik Control Eengineering</i>, essligen 1987. [3] Jhon Pippenger &amp; Tyler Hicks, <i>Industrial Hidraulics</i>, McGraw-Hill Book Ce, Singapore, 1985.</p>
18.	Entrepreneurship	<p><b>Objectives:</b> Students are able to discern Entrepreneurship principle and apply it correctly</p> <p><b>Course Topics:</b></p> <ol style="list-style-type: none"> <li>1. Entrepreneurship principle</li> <li>2. To arise the Entrepreneurship skill</li> <li>3. Entrepreneurship strategy, Idea, creativity</li> <li>4. Planning and business management.</li> <li>5. Planning and capital management.</li> <li>6. Project feasibility</li> <li>7. Internship and marketing</li> <li>8. Entrepreneurship project</li> </ol> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>- Pinchot G. Kasip, Z. Intrapreneuring</li> <li>- Drucker. P.F. Inovasi dan Kewiraswastaan</li> <li>- Wijandi. S. Pengantar Kewirausahaan</li> </ul>
19.	Chemistry	<p><b>Objective:</b> Students are able to comprehend the chemical properties of various materials and metal corrosion in order to supports knowledge of engineering materials</p> <p><b>Course Topics:</b> Chemical elements of commercial metals, polymer chemistry, carbon chemistry: fuel and lubricants, Electrochemistry, Corrosion, corrosion prevention, corrosion properties of some metals.</p> <p><b>References:</b> [1] Sienko and Plane, <i>General Chemistriy</i>. [2] James e Brady, <i>General Chemistry : Principal and Structure</i>, John Wiley and sons singapore 1990. [3] Fontana, M.G, <i>corrosion engineering</i>, NACE, Texas. [4] Thretewey, Korosi, untuk mahasiswa Sains dan Rekayasawan, Gramedia, Jakarta.</p>



**20. Material Science**

**Objectives:**

Students are able to discern metal, metal structure, its application and production technique. Students are able to evaluate metal mechanical properties and to understand welding quality by Non Destructive Test (NDT) and Destructive Test.

**Course Topics:**

Class :

1. Mechanical properties and material test
2. Crystal structure
3. Metal deformation, iron, and steel
4. Carbon iron, cast iron, alloy metal and its application
5. Other metal

Laboratory:

1. Destructive test
2. Tank test
3. Impact test
4. Hardness test
5. Macro etza test
6. Fracture test
7. Non destructive test, visual test, magnetic, ultrasonic, radiography (x-ray), and penetrant test

**References:**

- Anwir, BS., Ilmu Bahan Logam I & II, Bharata Karya Aksara, Jakarta, 1976.
- Davies DJ. & Oelmann LA., Metallurgical Process Production Technology, Ditman Publishing Ltd, London 1985.
- Higgins RA., Materials The Engineering Technician, Second ed., Copy Right Licensing Agency Ltd. London 1987.
- Measurement of mechanical properties.
- Testing and inspection of Engineering Materials.
- Non Destructive Testing, Barry, Hull, Vermanjau

**21. Code and Piping System Standar**

**Objective:**

To give knowledge to students about the application, requirements, codes and standards of ship's piping systems.

**Course Topics:**

Definitions, Class division on piping systems, Certification of piping system components, Steel and non-steel piping, Tanks and piping system on ships, Piping system for internal combustion engines, Piping system for steam plant, Standard reference classification: ABS, BKI, LR, NKK.

**References:**

- [1]. \_\_\_\_,. BKI Volume III, Rules For Machinery
- [2]. \_\_\_\_, ABS PART 4, Rules For Piping and Machinery
- [3]. J. Wang and A. Pillay, Technology and Safety of Marine System, Elsevier Science, 2003.

**22. Marine Engineering System**

**Objectives:**

Provide knowledge of the main propulsion system and support systems on board, including rules and code standard used in ships.

**Course Topics:**

- Propulsion system on board
- Piping System:
- Bilge system
- Ballast system
- Sanitary system
- Cooling system
- Lubrication system
- Fuel system

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**References:**

- [1] Taylor, DA., Introduction To Marine Engineering, Butterworths – Heinemans Publisher.
- [2] Harrington, Roy L., Marine Engineering, Society of Naval Architects & Marine Engineer.
- [3] Testing and inspection of Engineering Materials.
- [4] Non Destructive Testing, Barry, Hull, Vermanjau.

**23. Pump and Compressor****Objectives:**

- Recognize principles of pumps, compressors and fans.
- Analyze the characteristics of various types of pumps, compressors and fans, including its problems.
- Identify the main aspect in design and application of various types of pumps, compressors and fans.

**Course Topics:**

- Pump's description and its limitation
- fan and compressor
- Energy and momentum transfer between fluid and rotor
- Characteristics of fans, pumps and compressor both centrifugal and axial flow.
- Losses
- Positive displacement pump
- Cavitation and water hammer problems with pump systems
- Application and design of pump for special purposes
- Laboratory experiments
- Performance's evaluation of various types of pumps and resolving various issues.

**References:**

- [1]. Karassik, Pump Handbook, McGraw-Hill, 1985
- [2]. J. Stefanoff, Centrifugal and Axial Flow Pumps, John Wiley & Sons, 1957
- [3]. E. Falje, Turbomachines: A Guide to Design, Selection and Theory, John Wiley & Sons, 1981
- [4]. N. S. G. Ra, Fluid Flow Machines, McGraw-Hill, 1988
- [5]. E. Brennen, Hydrodynamics of Pumps, Oxford University Press, 1994.

**24. Welding and Fabrication****Objectives:**

Students are able to discern metal welding mechanism and type, do the simple metal welding (fabrication), understand safety work in welding working area and are able to discern the metal structure deformation in HAZ.

**Course Topics:**Class :

1. Welding Metallurgy
2. Welding and cutting type.
3. Hand welding & Gas welding
4. Soldering/ Brazing
5. HAZ ( Heating Area Zone)
6. MIG/MAG Welding
7. Electricity Welding

Workshop :

## 1. SMAW

- Start up
- Butt joint. Lap joint, T-joint

## 2. OAW

- Start up
- But joint. Lap joint, T-joint

**References:**

- G.A. Kennedy, Welding Technology, 2nd ed, the Bobbs Meril company, Inc, 1982
  - AWS, Welding Hand Book
-

- ASME, Section IX
- AWS D2
- Cary, HB, Modern Welding Technology, 2bd ed, Pretice Hall, Englewoods cliffs, 1989
- H. Wiryosunarto dan Okumura T., Teknologi Pengelasan Logam, Pradnya Paramita, Jakarta ,1991.

25.	Refrigeration (HVAC)	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• To know about air conditioning and water vapor process. Application of thermodynamics, heat transfer and fluid flow principles to analyze heating, refrigerating and ventilation. Performance and component specifications and air conditioning system.</li> <li>• To apply psychrometry analysis into various HVAC systems.</li> <li>• To calculate heating and refrigerating displacement loads of the structure.</li> <li>• To calculate infiltration load.</li> <li>• To determine appropriate pipe size for both open and close systems.</li> <li>• To determine operation characteristics (head loss and flow rate) on the pipe and pump system.</li> <li>• To calculate the right size of ducting, both for high speed and low speed.</li> <li>• To calculate the operation characteristics (pressure and flow rate) on the ducting and fan system.</li> <li>• To determine the type, number, and diffuser placement of for air distribution.</li> <li>• To analyze compression refrigeration cycle and its components.</li> <li>• To calculate properties and analyze basic processes of two fluid mixtures of absorption refrigeration system.</li> <li>• To analyze absorption refrigeration cycle.</li> </ul> <p><b>Course Topics:</b>  Overview of HAVC building type and consideration. Psychrometry, steam process, conditioning room, basic heat transfer in building structures, solar time and solar angle. Solar irradiation. Heat Gean through penetration, Infiltration, Specific heat load, Cooling load calculation, CLTD / SCL / CLF methods, fluid review, piping systems and pumps, Air distribution system, Selection, installation and Fan performance, Design of air duct system. Review the refrigeration cycle, Refrigerant, Compressor, type and operation.</p> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>[1]. Mcquiston, F.C. and Parker, J. D., <i>Heating, Ventilating, and Air Conditioning, Analysis and Design</i>, 4th Ed., John Wiley and Sons, 1994.</li> <li>[2]. James E. Brumbaugh, <i>HVAC Fundamentals, Air Conditioning, Heat Pumps and Distribution Systems</i>, 4th Edition, Audel, 2004.</li> <li>[3]. Roger A. Fischer, <i>Air Conditioning and Refrigeration</i></li> </ol>
26.	Applied Machining	<p><b>Objectives:</b>  Students can operate machines as well as the preparation of the use of chisel tools, materials &amp; selection of machine tools.</p> <p><b>Course Topics:</b>  Lathe: surface, cylinder, tapered and deep, flat and angled scraping, milling, surface grinding, cylindrical grinding.</p> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>[1] <i>All About Machine Tools H</i>, Gerling</li> <li>[2] <i>Pengerjaan Logam DGW Mesin</i>, Alowz Sctcnements</li> <li>[3] <i>Westerman Tbles PSM- ITB</i></li> <li>[4] <i>Tool Design Construction PMS- ITB</i></li> </ol>
27.	English II	<p><b>Objectives:</b>  Students are able to response a passage about a problem and give exact solution in using English</p> <p><b>Course Topics:</b></p> <ol style="list-style-type: none"> <li>1. Meetings</li> <li>2. Cases</li> </ol>

### 3. Presentation

#### References:

- David Peaty, Something to Talk About
- Hutchinson, T., & Waters, A. .Interface
- Hadfield, J., Simple Writing Activities

#### 28. Automatic Control System

#### Objectives:

- a. To understand the concept of automatic control systems
- b. To analyze the Automatic Control Response System in transients

#### Course Topics:

- a. Application of Monitoring and Control Systems
- b. Basic equations of control system components
- c. Mechanical Systems, Electric.
- d. Hydraulic System, Pneumatic and Thermal
- e. Transfer-function for system control
- f. Block diagram for complex control system
- g. Steady state Response, Laplace transformation
- h. Inversion of Laplace transformation, Computer Solution, Transient response specifications
- i. Procedure of Root Locus Method Establishment
- j. Loci Equation

#### 29. Advanced Piping Drawing

#### Objectives:

This study emphasizes the engineering design and production of piping drawings using CAD Advance. The emphasis was on organizing and automation for process plant design and the use of object manipulation images. Introduced to students in the 3-dimensional construction and visualization in the design and construction process. Additional facilities in CAD, both in the form of software, and data importing prototype images are also used.

#### Course Topics:

Review the operating system and commands in CAD and piping terminology. Introduction CADWorx P & ID, CADWorx Structural Package. Mempuat models. Creating 3D piping models. Extraxt multiple views of 3D model. Using a 3D model to create 2D working drawings. Combining external database for instrument and process diagrams. Making piping specifications. Combining with CADWorx CADWorx Pipe Structural 3D models. The introduction of the software package Pro - Pipe. Piping components, making the new image. Line Menu, 3D polyline, Auto Elbow, Auto - pipe, Convert 2D drawing to 3D drawing, 3D drawing, 3D Clipping, Specification Generator.

#### References:

- [1]. Propipe version 13 imperial tutorial, Rebis Industry Workgroup Software.
- [2]. CADWorx User Guide 2006, COADE Inc.

#### 30. Sanitary Drainage System

#### Objectives:

To apply principles of sanitary drainage system

#### Course Topics:

#### Lesson:

- a. Basic principles of sanitary drainage management
- b. Sanitary drainage system
- c. Pump-System: Pressure and Pump power
- d. Determination of pump pressure on the installation
- e. Loss of Pressure
- f. Net Positive Section Head / NPSH
- g. Design of system

#### Practice:

- a. Symbols of sanitary drainage system
- b. Various sewage pipes
- c. Various Syphon / Trap
- d. Sewerage System
- e. Design of sanitary drainage system
- f. Piping Installation

**References:**

1. Sofyan M Noer Bambang dan Takoo Morimura, 1991, *Perencanaan dan Pemeliharaan Sistem Plambing*, Jakarta : PT Pradnya Paramida.
2. Sunaryo, 1986, *Plambing 1(Terjemahan)*, Semarang : IKIP Semarang Press.
3. Achmad Toekiman, 1994, *Teknologi Plambing*, Yogyakarta: FPTK IKIP Yogyakarta.
4. Murtiyono, 1995, *Petunjuk Kerja Pipa*, Pusat Pengembangan Pendidikan Politeknik, Bandung.
5. Simangunsong, Sergius, Drs., Mpd., Daryanto, Drs., 2003, *Teknologi Plambing*, Bayumedia Publishing, Malang.
6. Blankenbaker, E, Keith, 1987, *Modern Plumbing*, The Good Heart – Willcox Company, INC, Ohio.

31.	Pipe and Ducting Fabrication	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• To comprehend the procedures for pipe fabrication for threaded connections, sockets and welding.</li> <li>• To comprehend Structuring and fabrication of pipe deviation, vertical, horizontal</li> <li>• To comprehend fabrication of plumbing components</li> <li>• To comprehend fabrication of various deviation in plumbing</li> </ul> <p><b>Course Topics:</b></p> <p>Pipe Deviation; pipe straightening with heat; Hot tap procedures, safety, and possible danger; Bending Installation; Basic of Piping and Plumbing; Underground installation procedures with different types of material: cast iron, ductile iron, vitrified clay, concrete, carbon steel, fiberglass, and thermoplastic pipe; Measuring Tools; Methods of pipe connection and welding; The use of lifting tool for fabrication process.</p> <p><b>References:</b></p> <p>[1]. Tim Remus, <i>Ultimate Sheet Metal Fabrication</i>, Motorbooks International.</p> <p>[2]. Ron Fournier, <i>Metal Fabricator's Hand Book</i>, HP Books; Rev&amp;Updtd edition.</p>
32.	Steam Generator Systems	<p><b>Objectives:</b></p> <ol style="list-style-type: none"> <li>a. To have the ability to identify principle of steam generator system.</li> <li>b. To comprehend the application of steam generator system</li> </ol> <p><b>Course Topics:</b></p> <p>Definition of steam engine, types, steam engine modules, variety of boiler, the function of steam engine modules, water treatment process of boiler feeder, steam generator system applications, both for industry and power plants.</p> <p><b>References:</b></p> <p>Birnie, <i>Marine Steam Engine and Turbine, 4<sup>th</sup> Ed.</i>, 1980</p> <p>Harrington, <i>Marine Engineering</i>, SNAME, 1977</p> <p>Shyakhin, <i>Steam Turbines</i></p> <p>Milton, J.H., <i>Marine Steam Turbines</i></p> <p>Woodward, J.B, <i>Marine Gas Turbines</i>, John Willey &amp; Sons, New York, 1975</p> <p>Dietsel, p., Sriyono, D., <i>Turbin Pompa dan Kompresor</i>, Erlangga, 1988</p> <p>Akimov, <i>Marine Power Plant</i>, Peace Publishing, USSR.</p>
33.	Indonesian Values and	<p><b>Objectives:</b></p>

<p>Ideology</p>	<p>Students are able to discern, comprehend, and inspire Civilization and education of country defense ( Pendidikan Pendahuluan Bela Negara(PPBN).</p> <p><b>Course Topics:</b></p> <ol style="list-style-type: none"> <li>1. Human Right and duty</li> <li>2. Democracy &amp; human right (HAM)</li> <li>3. The Archipelago concept</li> <li>4. National Defense concept</li> <li>5. National Strategy Politics</li> <li>6. GBHN</li> <li>7. Law Program of National Defense</li> <li>8. National Importance and Role in International Relationship</li> <li>9. Internationalization of fighting values in globalization era</li> <li>10. Basic theory of geopolitics and geographic strategy</li> </ol> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>- Cassese, A., Ham di dunia yang berubah, Yayasan Obor, Jakarta, 1994.</li> <li>- Soelaeman, MM. Ilmu Sosial Dasar: Teori dan Konsep Ilmu Sosial, Eresco, Bandung, 1995.</li> <li>- Soemarwoto, O., Indonesia dalam Kancah Isu Lingkungan Global, Pustaka Utama, Jakarta, 1992.</li> <li>- Sanit, A., Reformasi Politik, Jogjakarta, 1998</li> <li>- Soedarsono, S., Penyemaian Jati Diri, Strategi Membentuk Pribadi, Keluarga dan lingkungan menjadi Bangsa yang Profesional, Bermoral dan Berkarakter, Gramedia, Jakarta, 2000.</li> </ul>
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**34. Process Technology**

**Objectives:**

To study about design, fabrication and installation of piping systems in industrial process and power generation. Students are expected to comprehend the operational, fabrication and pump installation process, chillers, boilers and various other process tools.

**Course Topics:**

- a. Course materials include pipe installation systems at power plants and geothermal heating systems.
- a. Piping in the oil refinery industry, chemicals, textiles, and related process plant.
- b. API 579 regulations and requirements.
- c. Review of the relevant legislation.
- d. Introduction to the theory of fracture (fracture), fracture in low temperature applications in refinery and petrochemical processes.
- e. Assessment of damage due to corrosion.

**References:**

- [1]. Michael Frankel, *Facility Piping System Handbook*, McGraw Hill – Professional
- [2]. Robert A. Meyers, *Petrochemicals Production Processes Handbook*, McGraw Hill.

<p><b>35.</b></p>	<p>Engineering Economics</p>	<p><b>Course Topics:</b></p> <ol style="list-style-type: none"> <li>a. Concepts of economic and environmental costs</li> <li>b. Micro and Macro Economics</li> <li>c. Relation between value of money – time</li> <li>d. Relation Application value of money – time</li> <li>e. Compare alternative with equivalent value methods</li> <li>f. Rate of Return Method and B/C Ratio</li> <li>g. Method of depreciation and depletion</li> <li>h. Income tax and cash flow forecasts</li> <li>i. Inflation and price changes</li> <li>j. Forecasting uncertainty</li> <li>k. Replacement analysis</li> <li>l. Allocation of capital and financing</li> </ol>
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m. Economic studies on the utility company

**References:**

- [1]. William G. Sullivan, Elin M. Wicks, James Luxhoj., *Engineering Economics, 12<sup>nd</sup>*, Prentice Hall.
- [2]. Park, Chan S., *Fundamental of Engineering Economics*, Prentice Hall.

36. Occupational Health and Safety

**Objective:**

- 1. Students are expected to comprehend about Occupational Health and Safety and its functions.
- 2. Students are able to identify the sources of danger in workplace, especially those related to piping and pressure vessels.
- 3. Students are able to provide an alternative solution for the prevention of accidents in workplace.

**Course Topics:**

- Risk Assessment,
- Management of Risk (Risk Management)
- HAZOPS
- Material Handling Safety
- Hazard Identification and Control
- Hazard Communication Program
- Job Hazard Analysis
- Accident Investigation
- Log Out / Tag Out
- Chemical Spills Response
- Safety and the Supervisor
- Operation Safety Committee / Problem Solving
- Confined Space Safety
- First Industrial Aids
- Workplace Emergency Action Plans
- Audit & OHS Implementation

**References:**

- [1]. Tjandra Yoga Aditama, *Kesehatan Dan Keselamatan Kerja*, Universitas Indonesia Press, 2002
- [2]. Suma'mur P.K. Dr. M. Sc. *Keselamatan Kerja & Pencegahan Kecelakaan*, Pt. Toko Gunung Agung, 2001
- [3]. Drs. Daryanto, *Keselamatan Dan Kesehatan Kerja Bengkel*, PT. Rineka Cipta.

37. Thermal Piping Design

**Objective:**

- ♣ Apply the concept of energy in plumbing problems with thermal fluid. Project design of incompressible and compressible flow, thermodynamics, heat transfer, power generation, and alternative energy systems.
- ♣ Learn the basic principles of laying, pumps, heat exchangers, modeling and optimization in designing thermal systems.
- ♣ Have the ability to design thermal system.
- ♣ To be able to use design tools such as Mathcad, SolidWorks (CAD) and Fluent, Ansys (CFD) to make a fashion representative models to simulate thermal system.

**Course Topics:**

- Pumps and piping systems
- Performance and characteristics of pump
- Design of piping systems
- Double-pipe heat exchanger
- LMTD and NTU methods
- Shell and tube heat exchangers
- Modeling thermal equipment
- Heat recovery systems
- Curve fitting
- Optimization
- Solar collector and storage system.

**References:**

- [1]. *Design of Fluid Thermal Systems*, " 2<sup>nd</sup> ed., by William S. Janna, PWS Publishing Co.
- [2]. *Design of Thermal Systems*", 3rd Ed, by W. F. Stoecker, McGraw-Hill

**38. Project Management****Objectives:**

To comprehend about project management that ensures diselesaikan can work with on time, on budget and good quality. Able to understand the techniques - techniques for achieving the three objectives of the project management. Able to manage budgets, time (schedule), and the quality of the work.

**Course Topics:**

- Introduction to Project Management
- Project Planning, Project acquisition and Risk Analysis
- Identification, analysis and adjustment of risk factors
- Making proposals and RFPs
- Implementation of the project
- Scope of management
- Equipment and techniques to reduce errors
- Management of time, cost and quality,
- Identification and using of appropriate tools and techniques to manage project variables
- Software for project management
- Creating work breakdown structure and arrange project elements with the Microsoft project.
- Project Communication, general management skills, conducting successful meetings, behavior in the workplace.
- Tteam building, leading the project team, manage the development team.
- Project Completion.
- Project Termination
- Critical factor determining the success and the failure of the project
- Project manager responsibilities
- Create a detal work plan and budget
- Monitoring project
- Communicate effectively with project teams, clients, and supervisors
- Anticipation and prevention of potential problems.

**References:**

- [1]. Colleen Garton, Erika McCulloch, *Fundamentals of Technology Project Management*, Mc Press, 2005.
- [2]. James P. Lewis, *Fundamentals of Project Management*, 2<sup>nd</sup> edition, American Management Association, 2002.
- [3]. Sumardi Reksopoetranto, *Manajemen proyek pembangunan*, Lembaga Penerbit, Fakultas Ekonomi, Universitas Indonesia, 1992.

**39. Research Methodology****Objective:**

To study about the methodology of research and also the steps to take a research.

**Course Topics:**

- Types of research
- Variables and measurement
- Population and sampling
- Data collection methods
- Methods of analysis
- Method of data presentation
- Analysis and interpretation.

**References:**

- [1]. Benyamin Lakitan, Prof. Dr. Entis Sutisna Halim Dkk, *Metode Penelitian, Cetakan Ke II*, Penerbit Universitas Sriwijaya, 2000.
- [2]. Mardalis, Drs., *Metode Penelitian, Cetakan IV*, Pt. Bumi Aksara, 1999.



- [3]. Moh. Nasir Ph.D., *Metode Penelitian, Cetakan IV*, PT. Ghalia Indonesia, 1985
- [4]. Consuelo G. Sevilla Dkk., *Pengantar Metode Penelitian, Cetakan II*, Universitas Indonesia Press, 1993.

**40.** Design of Pressure Vessel and Steam Power Plant

**Objectives:**

Students are able to design pressure vessels and steam power plant. It is also connected its piping system based on codes and standards. Students are also expected to know about operational aspects of safe steam power plant.

**Course Topics:**

- Codes and standards for piping and boiler, ASME, CSA
- Power and Heating Boiler, maintenance and operational regulations.
- Steam aircraft design calculations, include; cylinder components, foundation structure, and cover, safety and safety relief valve, combustion chamber, combustion chamber and fuel
- Pressure vessel design calculation,, include; shell, foundation, reinforcement
- Plumbing materials and manufacturing methods
- Commercial pipe size
- Strength
- Pipe joining methods
- Support
- Steam piping layout in the plane and pressure vessels

**References:**

- [1]. Mohammad A Malek, *Power Boiler Design, Inspection, and Repair , 1<sup>st</sup> edition*, McGraw-Hill Professional, 2004.
- [2]. Brad Buecker, *Basics of Boiler and Hrsg Design*, Pennwell Books, 2002.
- [3]. Somnath Chattopadhyay, *Pressure Vessels: Design and Practice (Mechanical Engineering)*, CRC , 2004
- [4]. Dennis R. Moss, *Pressure Vessel Design Manual, Third Edition*, Gulf Professional Publishing, 2003.
- [5]. Henry H. Bednar , *Pressure Vessel Design Handbook, 2nd edition*, Krieger Publishing Company, 1991

**41.** Pipe Laying and Support

**Objectives:**

- To comprehend the piping laying system
- To comprehend the purpose, design and the use of piping support.

**Course Topics:**

Type of pipe supports, Spring Support, Support Assembly, Pipe Shoes and Anchor, Slide Plates, Expansion Joint, Specification of Pipe Support and Layout, Pipe support fabrication.

**References:**

- [1]. Michael Frankel, *Facility Piping System Handbook*, McGraw Hill – Professional
- [2] Paul R. Smith, Thomas J. Van Laan., *Piping and Pipe Support System : Design Engineering*, McGraw

**42.** Piping System and Models

**Objective:**

Students are able to design and make the modeling of piping systems.

**Course Topics:**

- Basics of modeling.
- Piping Model Material.
- Evaluation of Modelling
- Optimization System
- Reliability Analysis
- Modelling
- Model Characteristics Test

**References:**

- [1]. Ernest Schulbe, *Advanced piping and modelling*, 2<sup>nd</sup> rev. edition, Sherratt & Hughes.
- [2]. G. P. Peterson, *An Introduction to Heat Pipes : Modeling, Testing, and Application*, Wiley-Interscience, 1994
- [3]. \_\_\_\_\_, *Scale Model Detailing: Projects You Can Do*, Kalmbach Publishing Company, 1995

43.	DFKI (design, fabrication, Construction, Inspection) Tank and Pipe	<p><b>Objective:</b> Students know various types and stages of manufacturing process and inspections on piping fabrication. Students are be able to conduct inspections according to the procedures correctly.</p> <p><b>Course Topics:</b></p> <ol style="list-style-type: none"> <li>a. Procedures and interpretations affecting the tensile testing, impact, hardness and fatigue.</li> <li>b. Test specimen.</li> <li>c. Physical, mechanical, and thermal charateristics of iron and steel materials, ability to resist the corrosion,</li> <li>d. Welding defects, dimensional defects, structural discontinuities</li> <li>e. Nondestructive testing, visual inspection, magnetic particle inspection, liquid penetrant testing</li> <li>f. Proof tests, leak tests, ultrasonic, radiography, acoustic emission.</li> </ol> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>[1]. Gil, Taylor., <i>Piping and Plumbing System, An Inspection Notes</i>, 1<sup>st</sup> Edition, Mc Graw-Hill Professional, 2005</li> <li>[2]. Gil, Taylor., <i>HVAC Inspection Notes</i>, 1<sup>st</sup> Edition, Mc Graw-Hill Professional, 2005</li> </ol>
44.	Fire Fighting - Pipe System	<p><b>Objectives:</b> Students are able to comprehend basic fire extinguishing system and able to design piping systems for firefighters.</p> <p><b>Course Topics:</b> Fire principles, types of fire hazard. Firefighting process, Design and layout Sprinkler System, Material and standard code of fire extinguishing system, Fire pump installation.</p> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>[1]. Mark Bromann, <i>The Design and Layout of Fire Sprinkler Systems</i>, Second Edition, CRC, 2001.</li> <li>[2]. Caroline Paul, <i>Fighting Fire</i>, St. Martin's Paperbacks, 1999.</li> <li>[3]. Robert Gagnon, <i>Design of Water-Based Fire Protection Systems</i>, 1<sup>st</sup> edition, Thomson Delmar Learning, 1996.</li> </ol>
45.	Design of Ship Piping System	<p><b>Course Topics:</b> Design Plan, Piping systems in ship, Selection of Main Engine, transmission and axis system, Lubrication and Refrigeration Systems, Air-Start System, Piping Support.</p> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>[1].Marine Engineering</li> <li>[2].Engine Project guide</li> <li>[3].Piping drawing handbook</li> </ol>
46.	Oil Exploration System	<p><b>Objective:</b> To comprehend about exploration and exploitation of oil and gas, oil &amp; gas drilling and processing station, oil and gas carrier, oil and gas pipeline: planning and construction.</p>
47.	On the Job Training (OJT)	<p><b>Objectives:</b> To introduce the real working condition for the students. Students are able to apply knowledge on piping-related technology industries.</p>

**48.** Piping System Design Project

**Objective:**

- a. To apply heat transfer and fluid flow concepts to design a thermal fluid system
- b. To introduce a methodology and thermal design calculations
- c. To provide experience in the field of fluid thermal design, including piping systems, heat exchangers, HVAC and energy.
- d. Project design is selected from industrial applications and are determined by team.

**Course Topics:**

Optimization Design. Piping Systems Design, review of fluid mechanics, pipe standard, hydraulic resistance, various pumps and its applications, Heat Exchanger Design; review of heat transfer, Extended Surface Heat Transfer, Longitudinal Fins, Spines, Fin Performance, Heat Exchanger Type, Design Method of Heat Exchanger.

**References:**

- [1]. Roy A. Parisher, Robert A. Rhea, *Pipe Drafting and Design*, Second Edition, Gulf Professional Publishing, 2001.
- [2]. AWWA Staff, *Steel Pipe - A Guide to Design and Installation*, 2<sup>nd</sup> edition, American Waterworks Association, 2004.
- [3]. Paul R. Smith, Thomas J. Van Laan, *Piping and Pipe Support Systems: Design and Engineering*, McGraw-Hill.
- [4]. Mohinder L. Nayyar, *Piping Handbook*, 7<sup>th</sup> Edition, McGraw-Hill Professional.

**49.** Religion Islamic Values

2/2

**Objectives:**

Students are able to understand, recognize and belief about Muslim religion and are able to understand and belief the truth of Islam and apply it in daily life by using Al-Quran guidance and *Sunnah* of the prophet Muhammad SAW.

**Course Topics:**

1. Role of Religion in life
2. Concept of Islam about God, faerie, holy Quran
3. Islam Rule
4. Universe Creation
5. Human in Moslem
6. Self-Consecration
7. Personal Education and Social
8. Moral
9. Family and Moslem Society
10. Science and Technology in Islam

**References:**

- Department of Religion, Al-Quran and the translation, Bumi Restu Press., Jakarta, 1971
- Religion Lecturers of ITS, Basic of Moslem Religion
- Nasution, H., Islam in Several Aspects, UI Press, Jakarta 1979.
- Syaifudin E.A., The Vision of Islam, Pustaka, Jakarta 1985

Catholic

2/2

**Objectives:**

Increasing understanding concept of belief in Church. Life in Christ and society in developing attitude and mental of Catholic person which can prove themselves in Indonesian society to reflect their belief.

**Course Topics:**

1. Belief in Church
2. Church as Safety Sacrament
3. Church Decision
4. Human Responsibility as the member of Church
5. Church Service
6. Leadership in Church

**References:**

- R. Hadiwiyono S.Y., Fostering Faith Church, Dopken MAWI, Jakarta
- Riberu, Y., Revelation For The Revealer, Luseat, Jakarta

- Yakobs. T., Dynamics Church, Canisius Foundation, Jogjakarta
- Budiyo, A.P., Comprehend Scriptures In group with 30 people, Canisius Foundation, Jogjakarta

Protestant	2/2	<p><b>Objectives:</b> Equip students to be able to grow and establish itself fully as a human person a new creation in Jesus Christ, fellow humans and the environment. Because it is willing to devote his entire life and all science for the benefit of fellow at all aspects and fields of life where she served for the honor and glory of God</p> <p><b>Course Topics:</b></p> <ol style="list-style-type: none"> <li>1. Religious consciousness in human life</li> <li>2. The meaning of faith (confession, revelation, testimony)</li> <li>3. Phenomologi religions (similarities and differences in understanding)</li> <li>4. Religion and Pancasila</li> <li>5. Man as the image of God (man responsible, man as bearer of the mandate of God)</li> <li>6. Human relations and science</li> <li>7. Meaning of God's law and calls for the life of society and nation</li> </ol> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>- Indonesian Bible Institute, Bible</li> <li>- Dahler, F.R., Religious Issues</li> <li>- Dr. Honig, Religion Science</li> <li>- Dr. Bleeker, Meeting of World Religions</li> <li>- Dr. Schuman, Olaf, Dialogue Inter-religious community</li> <li>- Dr. Walter Lempp, Responsible Students</li> <li>- Dr. Walter Lempp, Building Human Development</li> <li>- Dr. H.Hadiwijono, Christian Faith</li> <li>- Brownly, M, Ethical Decision Making</li> <li>- Dr. DC. Mulder, Christian Faith and Science</li> </ul>
Hinduism	2/2	<p><b>Objectives:</b> Religious understanding and it's appreciation, strengthen confidence, faith and worship of a Hindus to Sang Hyang Widhi Wasa / God Almighty so that they can control their thinking, speaking and acting in his devotion to the Nation and the 1945 Constitution to support National development program.</p> <p><b>Course Topics:</b></p> <ol style="list-style-type: none"> <li>1. History of Hinduism</li> <li>2. The sources of Hinduism gospel</li> <li>3. Scope</li> <li>4. Mawa Darsana</li> <li>5. Tantrayaman</li> <li>6. Panca Siadha Tattwa</li> <li>7. Watur Marga Yoga pranata Sosial</li> <li>8. Kala Dharma</li> <li>9. Dhamada</li> <li>10. Budhisatewa dan the concept of religious harmony</li> </ol>
Buddhism	2/2	<p><b>Objectives:</b> Understanding, appreciate and practice of the precepts belief in Almighty God, Dharma and services to strengthen faith (Soddha) in maintaining the survival of religion, nation and state based on Pancasila and the Constitution of 1945.</p> <p><b>Course Topics:</b></p> <ol style="list-style-type: none"> <li>1. The nature of God Almighty</li> <li>2. The conception of religious harmony</li> <li>3. Budhisatwa dan Buddha</li> </ol> <p><b>References:</b></p> <ul style="list-style-type: none"> <li>- Dipuhtera, O., The image of Buddhism in the philosophy of Pancasila</li> <li>- The Ministry of Religion, P4 Guidelines for Buddhism</li> <li>- Project Procurement Buddhist Scriptures, Dharmapada</li> </ul>

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50. Project Work

**Objective:**

Students are able to apply their knowledge and skills acquired during the lecture in the form of scientific work.

**Course Topics:**

Literary studies, planning, manufacturing equipment, testing, and scientific writing.

**References:**

- [1]. Puslit ITS, *Bahan Penataran Metodologi Penelitian*, Pusat Penelitian ITS, Surabaya 1989.
  - [2]. Relevant literature.
-