ANNEXURE O: CURRICULUM OF BE MECHANICAL PROGRAMME
SEMESTER 1
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: MATH-105 Calculus & Vector Algebra
Credit Hours: 3-0
Contact Hours: (3, 0)
Text Book:

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Understand the concept of limit / continuity / derivatives / apply the derivatives to find extrema.</td>
<td>PLO 2</td>
<td>C2</td>
</tr>
<tr>
<td>2</td>
<td>Understand the notions of definite and indefinite integration / techniques of integration / apply the definite integrals to compute lengths of curves / area of regions / volume of solids.</td>
<td>PLO 2</td>
<td>C2</td>
</tr>
<tr>
<td>3</td>
<td>Develop an understanding of sequences and series / use different tests to check the convergence of the series.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Vectors, Scalars and Vector products.
2. Limits & continuity, techniques of finding limits.
3. Techniques of differentiation, Tangent lines and rates of change.
4. Chain rule, implicit differentiation, and linear approximation.
5. Extreme functions, Mean value theorems, Concavity.
7. Techniques of Indefinite integration
8. Definite integrals, properties of definite integrals.
9. Solids of revolution, Volumes by Cylindrical shell & Cross section
10. Arc length, Surface of revolution, Centre of mass
11. Properties, Differential and Integration of Transcendental function
12. Indeterminate forms and L Hospital rule, trigonometric integrals.
14. Sequence & Series
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: CS-102 Computer Systems and Programming

Credit Hours: 04
Contact Hours: (2, 2)

Text Book(s):
1. Turbo C Programming for the PC Robert Lafore

Reference Book(s):

Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
<td>1</td>
<td>Evaluate programming construct and articulate how it is used to achieve desired output using C++</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Program a computer-based solution to a well-defined problem. This includes developing a general flow of logic, identifying the variables, conditional/iterative execution, fail conditions.</td>
<td>PLO 5</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Articulate use of correct programming methodology for a given problem based on optimal/efficient design.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction to Computers:
   a. Computer components and systems
   b. Networks
   c. Operating Systems
2. Programming:
   a. Overview: What is programming? Computer configuration, algorithms, flowcharts, computer languages, generations and levels of programming languages, data and results, a typical IDE (Microsoft Visual C++ 6.0).
   b. Data: Data types, data representation, identifiers, reserved words, variables, constants
c. Input and Output: Standard Library, output, address operator, input, string i/o, character i/o, escape sequences, assignment statement, type casting.
d. Operators: Arithmetic operators, operator precedence, associativity
e. Selection: Relational and logical operators, if, if/else, nested if’s, conditional operator, conditional expressions, switch.
f. Repetition: While, do/while, for (;;), break and continue statements.
g. Functions: Programmer defined functions, library functions, storage classes, scope, parameter passing, and recursion.
h. Arrays: Input and output of data, searching, sorting, array of characters, arrays as parameters.
i. Structures: Structure declaration, accessing structure members, arrays of structures, passing structures as function arguments.
j. Pointers: Address and indirection operators, pointer arithmetic, pointers and arrays, call by value and call by reference, dynamic memory allocation.
k. Files: Opening and closing files, reading and writing text files.
l. Introduction to Object Oriented Programming: Classes, instantiation, member function, data members, constructors, destructors, function overloading, default arguments.

3. Introduction to Data Structures
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-110 Engineering Drawing and Graphics
Credit Hours: 2-0
Contact Hours: (1, 3)
Text Book(s): 1. First Year Engineering Drawing by A. C. Parkinson

Reference Book(s): 1. Engineering Drawing and Design by Cecil Jensen and Jay D. Helsel
2. Engineering Graphics by Craft Meyer and Boyer

Grading: As per NUST statutes.

Course Learning Outcomes:

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<tr>
<td>1</td>
<td>Comprehend the science of Engineering Drawing, so that they are able to convey their creative ideas effectively and make them familiarize with various machine components used.</td>
<td>PLO 1</td>
<td>C2</td>
</tr>
<tr>
<td>2</td>
<td>To effectively read , understand and reproduce engineering drawing</td>
<td>PLO 1</td>
<td>P3</td>
</tr>
<tr>
<td>3</td>
<td>To design and construct the individual ideas of products in the form of a complete engineering drawing.</td>
<td>PLO 3</td>
<td>C4</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Engineering Drawing
   a. Types of lines and usage
   b. Drawing Instruments and usage
   c. Sheet Planning and Dimensioning
   d. Orthographic projection, First and Third Angle
   e. Sectional Drawing
   f. Isometric Drawing
   g. Assembly Drawing
   h. Standard Part Drawing
2. Graphical Drawing
   a. Projection of points on different planes
   b. Projection and Traces of lines
   c. Projection and Traces of planes
   d. Introduction to auxiliary and oblique planes and views
e. Loci of points and generated curves
f. Types of solids, development and projection of solids
g. Section of solids on principal and auxiliary planes
h. Introduction to intersection of solids and surfaces
i. Introduction to AutoCAD
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-121 Workshop Practice
Credit Hours: 1-2
Contact Hours: (1, 6)


Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
<td>1.</td>
<td>Acquire and demonstrate skills in performing basic manufacturing</td>
<td>1</td>
<td>P-3</td>
</tr>
<tr>
<td></td>
<td>processes by practicing assigned tasks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Should develop an assigned product using available manufacturing</td>
<td>3</td>
<td>C-5</td>
</tr>
<tr>
<td></td>
<td>processes, through their own hands.</td>
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<td></td>
</tr>
<tr>
<td>3.</td>
<td>Demonstrate ability to work in a team by participating in group</td>
<td>9</td>
<td>C-3</td>
</tr>
<tr>
<td></td>
<td>projects.</td>
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</tbody>
</table>

Details of Syllabus

1. Basic theory of the following shops.
   a. Fitting shop
   b. Wood work shop
   c. Electrical shop
   d. Forging shop
   e. Foundry Shop
   f. Elementary Machine shop
   g. Welding shop.
   h. Gear making shop.
2. Practice on job in each shop.
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: HU-100 English
Credit Hours: 2-0
Contact Hours: (2, 0)
Text Book(s): 1. Grammar
2. Writing
3. Reading/Comprehension

Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

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<tr>
<td>1</td>
<td>Demonstrate basics of grammar, parts of speech and use of articles by written work</td>
<td>P10</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Demonstrate ability to discuss general topics and everyday conversation through oral discussions</td>
<td>P10</td>
<td>A2</td>
</tr>
<tr>
<td>3</td>
<td>Perform analysis of phrases, clause and sentence structure given in a statement / problem</td>
<td>P10</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Functional English.
   a. Basics of Grammar
   b. Parts of speech and use of articles
   c. Sentence structure
   d. Active and passive voice
2. Comprehension  
   a. Answers to questions on a given text

3. Discussion  
   a. General topics and everyday conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

4. Listening  
   a. To be improved by showing documentaries/films carefully selected by subject teachers

5. Translation skills  
   a. Urdu to English

6. Paragraph writing  
   a. Topics to be chosen at the discretion of the teacher

7. Presentation skills  
   a. Introduction  
   b. Extensive reading is required for vocabulary building
Subject: HU-101 Islamic Studies
Credit Hours: 2-0
Contact Hours: (2, 0)
Text Book(s): 1. Islamic Education by A.S. Bukhari & M. D Zafar
Reference Book(s): 1. Muslim’s Character by M. Alghazali
Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
<td>1</td>
<td>Demonstrate the understanding of fundamental human rights and relation with non-Muslims through discussion on related issues</td>
<td>P6</td>
<td>C2</td>
</tr>
<tr>
<td>2</td>
<td>Demonstrate knowledge of Islamic civilization and moral values through assignments / exam questions</td>
<td>P8</td>
<td>C2</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Subjective Study of the Holy Quran and Hadith
   a. The meaning of Islam:
   b. Ibadaat (Worship)
   c. Amr Bil Baroof wa Nabi anll Munkir (Commands and Prohibition)
   d. Unity of Ummah
   e. Kasb-I-Halal (Lawful Earning)
   f. Fundamental Human Rights
   g. Relation with non-Muslims
2. Holy Prophet - As a Model of excellence
3. The System of Morality Development
4. Islamic Civilization
SEMESTER 2
Subject: MATH-121 Linear Algebra and ODEs
Credit Hours: 3-0
Contact Hours: (3, 0)
Reference Book(s): 1. Glyn James, Modern Engineering mathematics
Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
<td>1</td>
<td>Define and demonstrate properties of matrices used to solve systems of linear equation</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Solve first and higher order ODEs using conventional methods</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Apply the Laplace transform to solve initial value problems.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction to matrices, Algebra of matrices, Special matrices.
2. Determinants and their properties.
3. Linear independence, bases, Vector space.
4. System of linear equation. Gauss elimination
5. Eigenvalues, Eigenvectors.
6. Introduction to Differential Equations
   a. ODE of First order and first degree
   b. ODEs of second and higher orders.
   e. Solution of ODEs using Laplace Transforms.
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: CH-101 Applied Chemistry
Credit Hours: 03
Contact Hours: (2, 1) or (3, 0)

Reference Book(s):
1. J.W Moore, W.G Davices: Collings: Chemistry
2. M.Z Iqbal Chemistry for BSc
3. G.R.V.Heeke; Karuikstic : Lasers in Chemistry
4. M A Usmani Engineering Chemistry el
5. F Shumura, Semiconductors Silicon, Crystal Technology
6. Brady, Russell, Hulum Chemistry for BSc

Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
<td>1</td>
<td>Demonstrate understanding of fundamental concepts of matter by applying them to given situations / problems</td>
<td>P1</td>
<td>C2</td>
</tr>
<tr>
<td>2</td>
<td>Solve basic volumetric and solid state problems by applying the solution chemistry and solid state laws</td>
<td>P1</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Demonstrate understanding of environment and hazards related to it by applying to a given situation / problem</td>
<td>P1</td>
<td>C2</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Electro chemistry
2. Corrosion and its applications
3. Chemistry of engineering materials
4. High polymers
5. Thermo chemistry
6. Fuels
7. Solution Chemistry
Subject: PHY-102 Applied Physics
Credit Hours: 03
Contact Hours: (2, 1) or (3, 0)
Reference Book(s): Halliday & Resnick, Physics, Latest edition
Grading: As per NUST statutes.

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<tbody>
<tr>
<td>1</td>
<td>Define the basic terminologies related to applied physics</td>
<td>P1</td>
<td>C1</td>
</tr>
<tr>
<td>2</td>
<td>Apply problem solving techniques used in applied physics to relevant problems</td>
<td>P1</td>
<td>C2</td>
</tr>
<tr>
<td>3</td>
<td>Solve appropriate physics problems using vector mathematics</td>
<td>P1</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Polarization and Speed of light.
2. EM Spectrum, Reflection & Refraction.
4. Fiber Optics.
5. Simple Harmonic motion.
6. Waves in elastic media. (Strings and acoustical pipes).
7. General solutions to the wave equation.
8. Geometrical optics of spherical mirrors and refracting surfaces.
9. Thick and thin lenses.
10. Optical instruments.
11. Mechanical properties of materials.
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: HU-107 Pakistan Studies

Credit Hours: 2-0
Contact Hours: (2, 0)
Text Book(s): 1. The Emergence of Pakistan, Chaudhry Muhammad Ali, University of the Punjab, Lahore, 1979.

Reference Book(s): 1. Issue in Pakistan’s Economy by Akbar S. Zaidi.
2. Pakistan’s Foreign Policy: A Reappraisal by Shahid Amin Mahmood.
3. Human Rights Pakistan Studies Compulsory HEC, Islamabad

Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
<td>1</td>
<td>Analyse the contemporary problems faced by Pakistan (social, human resource, economic development, food safety / water resources) through discussion</td>
<td>P6</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Demonstrate the understanding of political and constitutional system of Pakistan through discussion</td>
<td>P6</td>
<td>C2</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Genesis of Pakistan.
4. Pakistan in the Comity of Nations.
5. Social & Environmental Problems in Pakistan.
Subject: ME-111 CAD
Credit Hours: 1-1
Contact Hours: (4, 0)


Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
<td>1</td>
<td>Use the computer based graphics and modelling software to design parts</td>
<td>PLO 5</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Develop a computer aided manufacturing programme</td>
<td>PLO 3</td>
<td>C5</td>
</tr>
<tr>
<td>3</td>
<td>Feature based designing of complex geometries using CAD software</td>
<td>PLO 3</td>
<td>C5</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction
2. Geometric Modelling Systems
3. Wire frame Modelling Systems
4. Surface Modelling Systems
5. Solid Modelling Systems
6. Modelling Functions
7. Data Structure
8. Euler Operations
9. Calculation of Volumetric Properties
10. Non-manifold Modelling
11. Assembly Modelling Capabilities
12. Basis Functions of Assembly Modelling
13. Browsing an Assembly
14. Features of Concurrent Design
15. Use of Assembly Models
16. Simplification of Assemblies
18. Introduction to modelling software e.g. Pro/E, Solid Edge/Works or as available.
19. Feature based designing of flat parts using CAD software
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-112 Engineering Statics
Credit Hours: 3-0
Contact Hours: (3, 0)
Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
<td>1.</td>
<td>Determine Resultant of force vectors in a plane or space using Scalar or Vector approach</td>
<td>PLO-1</td>
<td>C3</td>
</tr>
<tr>
<td>2.</td>
<td>Compute moments about a point and about an axis by Scalar or Vector approach</td>
<td>PLO 1</td>
<td>C3</td>
</tr>
<tr>
<td>3.</td>
<td>Draw Free Body Diagram and apply equations of equilibrium in 2 and 3 dimensions</td>
<td>PLO-1</td>
<td>C3</td>
</tr>
<tr>
<td>4.</td>
<td>Compute forces in members of trusses by method of joints and method of sections</td>
<td>PLO-1</td>
<td>C3</td>
</tr>
<tr>
<td>5.</td>
<td>Solve problems which include frictional forces and friction angles using equilibrium equations</td>
<td>PLO-1</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Force Systems
2. Moment
3. Equilibrium
4. Structures
5. Friction
6. Centre of Gravity and Centroid
7. Moments of Inertia
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-130 Thermodynamics I

Credit Hours: 3-0
Contact Hours: (3, 0)
Text Book(s):

Reference Book(s):

Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
<td>1</td>
<td>To demonstrate understanding of the laws of Thermodynamics by applying to a given problem</td>
<td>PLO 1</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>To analyse the Thermodynamic Systems by applying fundamental knowledge of Thermodynamics</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>3</td>
<td>To propose solution of a given Thermodynamics problem related to energy interaction</td>
<td>PLO 2</td>
<td>C5</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction
2. Properties of pure substances
3. First law of thermodynamics (closed system)
4. First law of thermodynamics (open system)
5. Second law of thermodynamics
6. Second law of thermodynamics (entropy)
SEMESTER 3
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: MATH-241 Vector Calculus and PDEs

Credit Hours: 3-0
Contact Hours: (3, 0)


Grading: As per NUST statutes.

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<tbody>
<tr>
<td>1</td>
<td>Demonstrate the basic properties of lines, planes or surfaces by using analytical geometry</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Compute Line, Surface or triple integrals by using notions of vector calculus</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Solve wave/ heat equation by using separation of variables or Fourier series</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Vectors, Scalars and Vector products.
2. Analytical Geometry in 3-space, Cylindrical and Spherical coordinates
4. Curves, Tangents, Arc length of a curve.
5. Velocity, Acceleration, Curvature & Torsion of a curve.
7. Divergence of a Vector Field
8. Curl of a Vector Field
9. Gradient, Divergence and Curl in Curvilinear coordinates.
10. Line integral, integration around closed curves.
11. Application of double integrals, Green’s theorem.
12. Tangent planes, Surface normal.
13. Surface integrals
16. Stokes’s theorem.
17. Solution of Partial differential equations
Subject: HU-109 Communication Skills

Credit Hours: 2-0
Contact Hours: (2, 0)
Text Book(s):
3. Steve M.Gerson/Sharon J. Gerson Technical Writing; Addison Wesley Longman (Singapore) Pte. Ltd.
4. Better Vocabulary by Edie Schwager

Reference Book(s): NIL

Grading: As per NUST statutes.

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<tbody>
<tr>
<td>1</td>
<td>Demonstrate written and oral multimedia presentation skills by preparing presentation materials / assignments</td>
<td>P10</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Demonstrate ability to give / receive clear instructions through written communication</td>
<td>P10</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Demonstrate the ability of effective written communication by writing effective reports</td>
<td>P10</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Speaking Skills
   a. Phonetics in effective Communication
   b. Phonetic Transcription
   c. Pronunciation
   d. Varieties of English
   e. Stress and Intonation
   f. Barriers in Effective Verbal Expression
   g. Art of Discussion and Debate
   h. Public Speaking.
   j. Vocabulary Building.
2. Reading Skills:
   a. Structure of English Language
   b. Grammar and Syntax
   c. Skimming of gist of a Text
   d. Scanning for specific information

Self-Assessment Report – SMME, NUST
e. Fast Reading
f. Understanding of punctuation
g. Understanding context
h. Understanding the relationship between sentences and clauses in a text
i. Recognizing the effects of style
j. Making inferences

3. Presentation and listening skills:
   a. Principles of Technical Communication
   b. Multimedia and Paper Presentations
   c. Presentation Practice by the students.
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-210 Engineering Dynamics

Credit Hours: 3-0
Contact Hours: (3, 0)
Text Book(s):

Reference Book(s):

Grading: As per NUST statutes.

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<tbody>
<tr>
<td>1.</td>
<td>Draw Free Body Diagram and solve problems related to particle or</td>
<td>PLO 1</td>
<td>C3</td>
</tr>
<tr>
<td></td>
<td>rigid body dynamics in 2-D or 3-D using Newton’s second law applied</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>to linear or angular motion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Apply the principle of work and energy to solve problems related</td>
<td>PLO-1</td>
<td>C3</td>
</tr>
<tr>
<td></td>
<td>to kinetics of particles or rigid body planar kinetics.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Apply the principles of linear and angular momentum to solve</td>
<td>PLO-1</td>
<td>C3</td>
</tr>
<tr>
<td></td>
<td>problems related to particles or to rigid body planar kinetics.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Kinematics of a Particle
2. Kinetics of a Particle: Force & Acceleration
3. Kinetics of a Particle: Work & Energy
4. Kinetics of a Particle: Impulse & Momentum
5. Planar Kinematics of a Rigid Body
8. Introduction to Planar Kinetics of a Rigid Body: Impulse & Momentum
9. Introduction to Three Dimensional Kinematics and Kinetics of Rigid Bodies
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-220 Engineering Materials
Credit Hours: 3-0
Contact Hours: (3, 0)
Text Book(s):

Reference Book(s):

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Describe bonding / properties / solidification / crystallisation / defects using miller indices / metallography.</td>
<td>P1</td>
<td>C2</td>
</tr>
<tr>
<td>2</td>
<td>Demonstrate understanding engineering material’s structure by using material related data.</td>
<td>P1</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Analyse material properties obtained from mechanical testing of different materials through experimental techniques / provided experimental data.</td>
<td>P1</td>
<td>C4</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction to Materials background, development along the civilizations.
2. Materials for the Defence and Commercial Industry
3. Materials atomic structure and correlation with their properties.
4. Solidification and Crystallization.
5. Diffusion and solid solutions
8. Ceramic materials; their properties and applications.
9. Polymers; their properties and applications.
10. Composites.
11. Introduction to single and poly-crystal materials.
12. Ferrous and Non-Ferrous Metals.
15. Material’s damaging modes during applications; Fracture, Fatigue, Wear etc.
17. Materials naming conventions as per AISI-SAE, ASTM, ISO/BS standards.
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-230 Fluid Mechanics I
Credit Hours: 3-0
Contact Hours: (3, 0)


Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demonstrate the concepts of fluid mechanics based on analytical relations</td>
<td>PLO 1</td>
<td>C2</td>
</tr>
<tr>
<td>2</td>
<td>Carry out the problem solutions involving the pressure difference of moving fluids by using Euler/Bernoulli equations</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Apply the concepts of control volume to interpret the flow field</td>
<td>PLO 4</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Fluid properties.
2. Fluid statics
3. Kinematics of flow
4. Fluid kinematics
5. Equation of continuity, flow energy equation
6. Dimensional analysis and similitude
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-231 Thermodynamics II

Credit Hours: 3-0
Contact Hours: (3, 0)


Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To apply the principle of thermodynamics to Gas Mixtures / Gas Power Cycles.</td>
<td>PLO 1</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>To analyse any one of the following: Gas Mixtures, Thermodynamic Cycles or Combustion Process.</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>3</td>
<td>To solve problems in the areas of Applied Thermodynamics based on the topics studied in the course.</td>
<td>PLO 2</td>
<td>C5</td>
</tr>
</tbody>
</table>

Details of Syllabus:

1. Review of thermodynamics
2. Thermodynamic property relations
3. Mixtures
4. Gas power cycles
5. Vapour and combined power cycle
6. Chemical reactions and equilibrium
7. Dynamic machine theory
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-232 Thermodynamics Lab

Credit Hours: 0-1
Contact Hours: (3, 0)
Text Book(s): NIL

Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
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<th>No</th>
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<tr>
<td>1</td>
<td>An ability to conduct experiments, as well as to analyse and interpret data</td>
<td>PLO 2</td>
<td>P3</td>
</tr>
<tr>
<td>2</td>
<td>An ability to function on multi-disciplinary teams.</td>
<td>PLO 9</td>
<td>A2</td>
</tr>
<tr>
<td>3</td>
<td>Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>PLO 5</td>
<td>P3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Experiments related to the subject of ME-130 Thermodynamics-I and ME-231 Thermodynamics-II
SEMESTER 4
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: MATH-231 Fourier and Complex Analysis
Credit Hours: 3-0
Contact Hours: (3, 0)

Reference Book(s):

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To solve Partial Differential Equations for common Engineering systems.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Demonstrate the concepts of Fourier Series / Fourier Transform used to solve PDEs.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Expand the given series by using Complex Analysis.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Complex Numbers and Functions
2. Fourier series for functions of any period,
3. Even and Odd functions.
5. Fourier integral, Fourier Cosine and Sine Transforms.
6. Fourier Transform of the Derivatives, Convolution
7. Modelling a Vibrating String, Derivation of Wave Equation, Solution by the Method of Separation of Variables, using Fourier Series
8. D’Alembert’s Solution of the Wave Equation
10. Rectangular and circular membrane: Use of Double Fourier Series
11. Laplace’s Equation, Laplacian in Spherical Coordinates
12. C-R Equations, Cauchy Integral Theorem, Cauchy Integral Formula, Derivatives of Analytical Functions
Subject: EE-103 Electrical Engineering

Credit Hours: 3-0
Contact Hours: (2, 1)

Text Book(s):
1. Electric Circuits Fundamentals, Sergio Franco, OUP.
4. Electric Circuits, Basic Electricity by Schaum’s Series.

Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
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<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demonstrate system knowledge based on basic electrical properties</td>
<td>PLO1</td>
<td>C2</td>
</tr>
<tr>
<td>2</td>
<td>Be able to identify principal quantities based on electrical / magnetic circuits</td>
<td>PLO 1</td>
<td>C2</td>
</tr>
<tr>
<td>3</td>
<td>Understand characteristics of electrical systems based on AC/DC circuits.</td>
<td>PLO 1</td>
<td>C4</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction to DC Circuits:
   a. Series and parallel circuits,
   b. DC circuit analysis.
2. Theory of Alternating Current:
   a. Series and parallel circuits,
   b. Resistance, inductance and capacitance of AC circuits,
   c. Power factor,
   d. Resonance in RLC circuits,
   e. Single phase and poly-phase circuits,
   f. Power and power factor measurement,
   g. Current and voltage relationship in phase and line circuits,
   h. Types, characteristics and testing of AC motors,
   i. Motor starters and switch gears,
j. Electric traction and braking,
k. Solenoids.
3. Operational Amplifiers
4. Transformers:
   a. Voltage and current relationship of primary and secondary types of transformers,
   b. Losses and efficiency.
5. Generators and motors:
   a. Types, construction and characteristics,
   b. Motor starters
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-211 Mechanics of Materials I
Credit Hours: 3-0
Contact Hours: (3, 0)

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
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<tr>
<th>No</th>
<th>CLO</th>
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<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design axially loaded or torsional members under given loading conditions</td>
<td>PLO 3</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Design beams by using shear force or bending moment diagrams for provided loading conditions</td>
<td>PLO 3</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Discuss the basic concepts of fracture mechanics and their limitations</td>
<td>PLO 1</td>
<td>C2</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Tension, compression, and shear
2. Axially Loaded Members
3. Torsion
4. Shear Forces and Bending Moments
5. Stresses in Beams (Basic Topics)
6. Columns
7. Basic Fracture Mechanics
8. Thin cylindrical vessels
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-221 Manufacturing Processes

Credit Hours: 3-0
Contact Hours: (3, 0)
Text Book(s):

Reference Book(s):
2. Materials and Processes part B: Processes by James F. Young and Robert S. Shane (3rd Ed)

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
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<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Distinguish between different types of casting / differentiate between their output product characteristics.</td>
<td>PLO 1</td>
<td>C4</td>
</tr>
<tr>
<td>2</td>
<td>To analyse different manufacturing processes for plastics by discussing process mechanisms.</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>3</td>
<td>To investigate characteristics of major machining operations / basic components of the machine tools by analytical method.</td>
<td>PLO4</td>
<td>C4</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction and Basic Concepts of Manufacturing Processes
2. Foundry Practices & Contemporary Casting Processes
3. Metal Cutting Theory/ Cutting Tools
4. Conventional Machining Processes
5. Non-Conventional Machining Processes
6. Glass making/float glass process, blow moulding, spinning etc.
7. Bulk Deformation processes (Drawing, extrusion, sheet metal)
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-222 Mechanics and Manufacturing Lab I
Credit Hours: 0-1
Contact Hours: (3, 0)
Text Book(s): NIL
Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
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<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An ability to conduct experiments, as well as to analyse and interpret data</td>
<td>PLO 2</td>
<td>P3</td>
</tr>
<tr>
<td>2</td>
<td>An ability to function on multi-disciplinary teams.</td>
<td>PLO 9</td>
<td>A2</td>
</tr>
<tr>
<td>3</td>
<td>Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>PLO 5</td>
<td>P3</td>
</tr>
</tbody>
</table>

Details of Syllabus

Subject: ME-233 Fluid Mechanics II

Credit Hours: 3-0
Contact Hours: (3, 0)


Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analyse the compressible flows by solving problems related to transonic flows through varying area ducts.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Analyse the internal flows through solution of problems based on pipes and ducts by calculating their characteristics</td>
<td>PLO 9</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Analyse the external flow devices/turbo machinery by using the analytical relation.</td>
<td>PLO 5</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Flow in pipes and ducts (incompressible internal flow)
2. Boundary layer theories
3. Drag and lift (incompressible external flow)
4. Open channel flow
5. Compressible flow
6. Turbo machinery
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-234 Fluid Mechanics Lab

Credit Hours: 0-1
Contact Hours: (3, 0)
Text Book(s): NIL

Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An ability to conduct experiments, as well as to analyse and interpret data</td>
<td>PLO 2</td>
<td>P3</td>
</tr>
<tr>
<td>2</td>
<td>An ability to function on multi-disciplinary teams.</td>
<td>PLO 9</td>
<td>A2</td>
</tr>
<tr>
<td>3</td>
<td>Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>PLO 5</td>
<td>P3</td>
</tr>
</tbody>
</table>

Details of Syllabus

SEMESTER 5
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: MATH-361 Probability and Statistics
Credit Hours: 3-0
Contact Hours: (3, 0)


Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Describe and apply the basic concepts of probability and statistics used for data representation and sampling</td>
<td>PLO 2</td>
<td>C2</td>
</tr>
<tr>
<td>2</td>
<td>Use probability theory to analyse data for decision making and for solving problems.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Demonstrate the ability to work as an individual and team member by participating in class project</td>
<td>PLO 9</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Graphical Representation of Data: Stem-and-Leaf Plot, Histogram, Boxplot; Mean, Standard Deviation, Variance
2. Sample Space, Experiment Outcomes, Sampling with and without replacement, Set theory,
4. Permutations and Combinations
5. Random Variables and Probability Distributions
6. Mean and Variance of a Distribution, Expectation, Moments
9. Marginal distribution, Distributions of Several Random Variables
10. Random Sampling, Random numbers, Processing of Samples, Estimation of parameters.
11. Confidence intervals.
12. Testing of hypothesis.
13. Quality control, Control chart
15. Goodness of Fit, Chi-square test. Curve fitting.
16. Regression Analysis, Curve Fitting
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: HU-212 Technical and Business Writing

Credit Hours: 3-0
Contact Hours: (3, 0)
Text Book(s):
2. Technical Writing by Steve M. Gerson.
4. Technical Communication by Rebecca E. Burnett.

Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demonstrate skills in technical writing technical by writing memos/letters/reports, etc.</td>
<td>P10</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Apply research writing skills to write a piece of research work</td>
<td>P12</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Technical Writing:
   a. 7Cs of Tech Communication.
   b. Mechanics of Tech Writing, Comparison & Contrast
2. Research Writing Skills:
   a. Methodologies
   b. Techniques, Review of Literature.
   c. Research paper writing
3. Letter Writing:
   a. Formal/Informal Letters
4. Professional & Business Writing:
5. Memorandum
   a. Agenda Points – Notices
   b. Minutes of a Conference/Meeting
   c. Types of Tech Writing
   d. Preparing Model Correspondence
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-310 Mechanics of Materials II
Credit Hours: 3-0
Contact Hours: (3, 0)


Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analyse unsymmetrical beam bending or stresses in curved beams by theory of bending</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>2</td>
<td>Analyse buckling of columns using Euler formula</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>3</td>
<td>Design a structural member for failure based on theories of failure</td>
<td>PLO 3</td>
<td>C5</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Transformation of stresses and strains
2. Principal stresses and strains, Mohr’s circles, stresses on oblique planes, principal stresses
3. Theories of failure
4. Thick walled cylinders
5. Bending of beams
6. Buckling of columns
7. Rotating cylinders and discs
8. Basic contact mechanics
9. Unsymmetrical bending
Subject: ME-311 Machine Design
Credit Hours: 3-0
Contact Hours: (3, 0)

Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To calculate unknown parameters for screws based on given conditions.</td>
<td>P2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>To design weldments using welding standards / basic machine design theory.</td>
<td>P3</td>
<td>C5</td>
</tr>
<tr>
<td>3</td>
<td>To design Mechanical Springs / Shafts / Clutches / Brakes using standards / basic machine design theory.</td>
<td>P3</td>
<td>C5</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Screws, keys and couplings
2. Welded and riveted joints
3. Mechanical springs
4. Bearings
5. Shafts
6. Clutches, brakes, couplings and flywheels
7. Flexible mechanical elements
8. Gears and gear trains
9. Miscellaneous topics
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-312 Measurement and Instrumentation
Credit Hours: 2-0
Contact Hours: (2, 0)
Text Book(s): 1. Electronic Instrumentation and Measurements  David A. Bell

                    2. Labview for Engineers, Jeffrey Travis and Jim Kring

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Apply engineering measurement techniques by using any of the studied sensors.</td>
<td>P1</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Design experiments to estimate the accuracy of their measurements by developing a physical model.</td>
<td>P3</td>
<td>P4</td>
</tr>
<tr>
<td>3</td>
<td>Data Acquisition and Signal Processing for a given problem.</td>
<td>P3</td>
<td>C4</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Pressure Measurement
2. Flow Measurement
3. Temperature Measurement
4. Strain Gages
5. Data Acquisition and Processing
6. Virtual Instrumentation
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-323 Mechanics and Measurements Lab
Credit Hours: 0-1
Contact Hours: (3, 0)
Text Book(s): NIL
Reference Book(s): NIL
Grading: As per NUST statutes.

Course Learning Outcomes:

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<tbody>
<tr>
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<td>PLO 2</td>
<td>P3</td>
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<tr>
<td>2</td>
<td>An ability to function on multi-disciplinary teams.</td>
<td>PLO 9</td>
<td>A2</td>
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<tr>
<td>3</td>
<td>Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>PLO 5</td>
<td>P3</td>
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</table>

Details of Syllabus

NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: EE-212 Basic Electronics
Credit Hours: 3
Contact Hours: (2, 1)
Text Book(s):
Reference Book(s): NIL
Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Develop the understanding of elementary concepts required for the analysis and design of electronic circuits</td>
<td>P3</td>
<td>C5</td>
</tr>
<tr>
<td>2</td>
<td>Analyse basic principles of digital logic systems and their different applications</td>
<td>P2</td>
<td>C4</td>
</tr>
<tr>
<td>3</td>
<td>Demonstrate the basic architecture of microcontroller and microprocessor</td>
<td>P1</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Semiconductor Theory & Electronics Fundamentals
2. Diodes and its applications
3. Special Purpose Diodes
4. Bipolar Junction Transistors, Transistor Modelling, Field Effect Transistors
5. Number systems, Boolean algebra, gates.
6. Combinational logic (adders, comparators, decoders, multiplexers, etc.)
7. Sequential logic (flip-flops, registers, counters, ROM, PROM, EPROM).
8. Microprocessors (registers; ALU; CU; memory, address, data and control buses).
9. ADC and DAC. Micro-controllers.
SEMESTER 6
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: MATH-351 Numerical Methods

Credit Hours: 3-0
Contact Hours: (3, 0)

                        2. Donald Greenspan & Vincenzo Casulli: Numerical Analysis for Applied Mathematics, Science, and Engineering, Addison-Wesley

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apply fixed point, Newton’s, Secant or False position method to solve one variable equation.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Applying interpolation techniques to estimate the function values</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Find approximate solutions of second order linear/nonlinear ODEs and linear second order PDEs arising in engineering fields using Finite Difference Method</td>
<td>PLO 4</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Floating Point number system, Stability of Algorithm, Error analysis.
4. Numerical Differentiation
5. Cubic Spline Interpolation
8. LU Factorization: Doolittle’s, Crouts’s and Cholesky’s Methods
10. Method of least squares.
14. Neumann and Mixed Problem, Irregular Boundary
15. Solution of Parabolic PDEs: Crank-Nicolson Method
16. Solution of Hyperbolic PDEs
Subject: ME-313 Theory of Machines
Credit Hours: 3-0
Contact Hours: (3, 0)
Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
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<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To calculate the Centre of Gravity of a given geometry</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>To design a cam profile for given lift and dwell angles.</td>
<td>PLO 3</td>
<td>C5</td>
</tr>
<tr>
<td>3</td>
<td>To design a shaft structure so that it is balanced while fulfilling functional requirements.</td>
<td>PLO 3</td>
<td>C5</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Kinematics Fundamentals
2. Mechanisms: Types, Characteristics, and applications
3. Position Analysis
4. Velocity Analysis
5. Acceleration analysis
6. Dynamic Force analysis
7. Static and dynamic balancing
8. Cam design
Subject: ME-314 Control Systems
Credit Hours: 3-0
Contact Hours: (3, 0)
Grading: As per NUST statutes.
Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
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<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apply the knowledge of open/ close loop system to solve the given problem.</td>
<td>P2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Solve flow diagram/ mechanical system based on graphical/ mathematical modelling.</td>
<td>P2</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Carry out a root locus analysis for an engineering system.</td>
<td>P2</td>
<td>C4</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction to Control Systems
2. Mathematical models of systems
3. Feedback control system – characteristics and performance, Test input signals
4. The Root Locus Method
5. Frequency Response Method
6. State space method
Subject: ME-324 Engineering Management and Economics
Credit Hours: 2-0
Contact Hours: (2, 0)
Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To demonstrate the effect of economy on the society by showing understanding of the relationship between currency and division of labour</td>
<td>PLO 6</td>
<td>C1</td>
</tr>
<tr>
<td>2</td>
<td>To apply various tools for Economic Management of projects</td>
<td>PLO 11</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>To demonstrate the understanding of corporate management by applying relevant techniques</td>
<td>PLO 1</td>
<td>C2</td>
</tr>
</tbody>
</table>

Details of Syllabus

2. Type of Costs - Time value of money, Taxes, Cash Flow Diagrams.
3. Economics equivalence, the cost of capital, stock and bond valuation.
4. Investment and Replacement Analysis
5. Project Feasibility Analysis, Setting MARR, Type of Investments, Equity vs. Debt Financing, Depreciation Accounting,
6. Taxes and Inflation
7. Introduction to Balance sheet and financial statements.
8. Corporate Economics
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-330 Heat and Mass Transfer

Credit Hours: 3-0
Contact Hours: (3, 0)


Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To analyse basic principles for conduction heat transfer</td>
<td>P2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>To analyse basic principles for heat transfer with change of phase</td>
<td>P2</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>To design heat exchanger</td>
<td>P3</td>
<td>C4</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction
2. Conduction heat transfer
3. Forced convection
4. Free convection
5. Radiation
6. Heat transfer with change of phase
7. Heat exchangers
8. Mass transfer
Subject: ME-331 Refrigeration and Air Conditioning
Credit Hours: 3-0
Contact Hours: (3, 0)


Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Refrigeration systems and Cycles (Air, Vapour Compression, Absorption) and its analysis</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>2</td>
<td>Refrigerant and its properties, selection and challenges</td>
<td>PLO 1</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Describe the working of various refrigerating components</td>
<td>PLO 1</td>
<td>C3</td>
</tr>
<tr>
<td>4</td>
<td>Use of Psychometric chart to determine quality of air</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>5</td>
<td>Analyse the load of a space for heating and cooling</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction to air conditioning and refrigeration
2. Refrigerants and components
3. Refrigeration cycles
4. Psychometric
5. Air-conditioning
6. Heating and cooling load calculation - human comfort
7. Air transmission, distribution and system design
8. Water transmission, distribution and system design
Subject: ME-332 Heat Transfer and HVAC Lab

Credit Hours: 0-1
Contact Hours: (3, 0)
Text Book(s): NIL

Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An ability to conduct experiments, as well as to analyse and interpret data</td>
<td>PLO 2</td>
<td>P3</td>
</tr>
<tr>
<td>2</td>
<td>An ability to function on multi-disciplinary teams.</td>
<td>PLO 9</td>
<td>A2</td>
</tr>
<tr>
<td>3</td>
<td>Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>PLO 5</td>
<td>P3</td>
</tr>
</tbody>
</table>

Details of Syllabus

SEMESTER 7
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: 
ME-420 Project Management

Credit Hours: 
2-0

Contact Hours: 
(2, 0)

Text Book(s): 
3. Project Management by Harold Kerzner

Reference Book(s): 
1. Modern Production and Operation Management by Elwood S. Buffa
2. Operation Management by Roger G. Schroeder

Grading: 
As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To analyse decision making principles and their utilization in real problem solving.</td>
<td>PLO 11</td>
<td>C4</td>
</tr>
<tr>
<td>2</td>
<td>To evaluate various tools applied in Project Management</td>
<td>PLO 11</td>
<td>C6</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Project Planning and Scheduling
2. Gantt charts, PERT and CPM
3. Software on Project Management
4. Work Breakdown Structure (WBS)
5. Request for Proposal (RFP)
6. Project management
7. Case Studies
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: MGT-471 Entrepreneurship
Credit Hours: 2-0
Contact Hours: (2, 0)
Text Book(s):
2. S.S. Khanka, Entrepreneurial Development
4. Bruce A. Kirchhoff, Entrepreneurship and Dynamic Capitalism

Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ability to employ entrepreneurial skills</td>
<td>6</td>
<td>A3</td>
</tr>
<tr>
<td>2</td>
<td>Ability to make sustainable business plans</td>
<td>7</td>
<td>C3</td>
</tr>
<tr>
<td>3</td>
<td>Team building for successful businesses</td>
<td>9</td>
<td>A3</td>
</tr>
<tr>
<td>4</td>
<td>Ability to manage projects successfully</td>
<td>11</td>
<td>C3</td>
</tr>
<tr>
<td>5</td>
<td>Development of skills and learning throughout the project</td>
<td>12</td>
<td>A3</td>
</tr>
</tbody>
</table>

Details of Syllabus

2. Critical factors for setting up a new enterprise. Ingredients for a successful new business. Self-assessment and feedback, Personal entrepreneurial competencies. Goal setting. Creativity and sources of new business ideas, the difference between ideas and opportunity and creativity. Assessing business
opportunities in Pakistan. Screening and evaluating opportunities marketing as a philosophy, marketing management: Creating a marketing plan, analysing the environmental situation and the market opportunity, setting marketing objective, formulating a marketing strategy.


4. Product planning and development process. Creating parallel competition by developing a similar product or service, Product life cycle.
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-421 Mechanical Vibrations
Credit Hours: 3-0
Contact Hours: (3, 0)


Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
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<tr>
<th>No</th>
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<th>Level of Learning</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Analyse free vibrations of harmonically excited systems by application to a single dof system</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>2</td>
<td>Analyse single dof systems using energy method analysis</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>3</td>
<td>Apply numerical methods for determining the natural frequencies and mode shapes of a given system.</td>
<td>PLO 3</td>
<td>C3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Fundamental concepts
2. Free vibration of SDOF systems
3. Harmonically excited SDOF systems
4. SDOF systems excited by general forcing functions
5. 2DOF Systems
6. Introduction to MDOF systems
7. Introduction to MDOF systems
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-410 Dynamics and Controls Lab

Credit Hours: 0-1
Contact Hours: (3, 0)
Text Book(s): NIL
Reference Book(s): NIL

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
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<tr>
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<td>PLO 2</td>
<td>P3</td>
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<td>2</td>
<td>An ability to function on multi-disciplinary teams.</td>
<td>PLO 9</td>
<td>A2</td>
</tr>
<tr>
<td>3</td>
<td>Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>PLO 5</td>
<td>P3</td>
</tr>
</tbody>
</table>

Details of Syllabus

   a. Introduction to MATLAB
   b. Introduction to MATLAB functions I
   c. Introduction to MATLAB functions II
   d. Creating M-file and writing program
   e. Mathematical Modelling of a given Engineering Problem
   f. Solving a Mathematical model using FDM-I
   g. Solving a Mathematical model using FDM-II
   h. Analysis of response of system
   i. Analysis of Root Locus Method
   j. Introduction to SIMULINK
   k. Introduction to basic functions of SIMULINK
   l. Studying Step function using SIMULINK
   m. Analysis of response of Mass Spring System using SIMULINK
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-422 Production Tooling and Automation
Credit Hours: 2-0
Contact Hours: (2, 0)
Text Book(s):

Reference Book(s):
1. Yusuf Altintas—Manufacturing Automation
4. M C Shaw, Metal Cutting Theory and Practice

Grading:
As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demonstrate understanding of production tooling techniques by applying them to a given scenario</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Develop the ability to use manual coding to machine parts having complex contours and surfaces</td>
<td>PLO 3</td>
<td>C5</td>
</tr>
<tr>
<td>3</td>
<td>Compare various techniques to deploy jigs and fixtures under various requirements</td>
<td>PLO 3</td>
<td>C6</td>
</tr>
</tbody>
</table>

Details of Syllabus:

1. Production tooling
   a. Cutting tools
   b. Turning tool holders and milling cutters
   c. Jigs
   d. Fixtures
   e. Press tools

2. Automation
a. Introduction To automation
b. Single Station Manufacturing Cells; Group Technology and Cellular Manufacturing; Flexible Manufacturing Systems
c. Manual Assembly Lines; Transfer Lines and Similar Automated Manufacturing Systems; Automated Assembly Systems
d. Design for Automation
e. Introduction To NC Machines
f. Manual Part Programming
g. Computer assisted part programming, DNC, CNC, and Adaptive Control
h. Industrial Logic Control Systems, Logic Diagramming, Programmable Logic Controllers
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-423 Mechanics and Manufacturing Lab II
Credit Hours: 0-1
Contact Hours: (3, 0)
Text Book(s): NIL
Reference Book(s): NIL
Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
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<tr>
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<td>PLO 2</td>
<td>P3</td>
</tr>
<tr>
<td>2</td>
<td>An ability to function on multi-disciplinary teams.</td>
<td>PLO 9</td>
<td>A3</td>
</tr>
<tr>
<td>3</td>
<td>Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>PLO 5</td>
<td>P3</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Experiments related to the subject of ME-313 Theory of Machines and ME-422 Production Tooling & Automation.
   a. Introduction to Pro/E
   b. Introduction to sketch module
   c. Introduction to basic function of part module I
   d. Introduction to basic function of part module II
   e. Learning free sketching
   f. Introduction to helical sweep
   g. Introduction to assembly and mechanism
   h. Introduction to COMSOL and ANSYS
   i. Introduction to manufacturing module
   j. Final Project
SEMESTER 8
SUBJECT: HU-422 Professional Ethics

CREDIT HOURS: 2-0

CONTACT HOURS: (2, 0)

TEXT BOOK(S):

REFERENCE BOOK(S): NIL

GRADING: As per NUST statutes.

COURSE LEARNING OUTCOMES:

<table>
<thead>
<tr>
<th>No</th>
<th>CLO</th>
<th>PLO</th>
<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Students should be well versed with the norms of engineering ethics</td>
<td>P8</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>Students should have the capability to take responsibility for professional engineering practice</td>
<td>P6</td>
<td>C3</td>
</tr>
</tbody>
</table>

DETAILS OF SYLLABUS

1. Introduction
   a. Definitions/Importance/Kinds
   b. Factors/Sources of Islamic Ethics
   c. Islamic ethical system
   d. Ethics in Business
   e. Enforcement of ethical environment/Factors
   g. Islamic rules for business
   h. Lawful and unlawful behaviour in Islam
2. Engineering Ethics
   a. Scope & Aims, Theories, responsibilities
   b. IEEE code of Ethics
   c. Ethical code for engineers
   d. Ethical code for Software engineers
3. Moral Courage
   a. Moral courage, its importance and how to improve?
   b. Attributes of morally courageous leaders
4. Relevant Case Studies
ELECTIVES
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-443 Automotive Technology

Credit Hours: 2-1
Contact Hours: (2, 3)

2. Workshop/Repair Manuals of Vehicles & Engines used in the Practical Work.

Grading: As per NUST statutes.

Course Learning Outcomes:

To be defined before the next time when the course will be offered.

Details of Syllabus

1. Engine Fundamentals
2. Engine Cooling and Lubricating System
3. EFI and Carburettor Fuel Systems
4. Intake and Exhaust Systems
5. Clutches, manual transmissions and transaxles
6. Drive lines and shafts
7. Rear axles and final drives
8. Tyres, Wheels and Brakes
9. Suspension and Steering Systems
10. Wheel Alignment

Syllabus for Practicals:
1. Dynamometer
2. Engine Measurements
3. Wheel Alignment and Balancing
4. Engine Timing
5. Engine Compression
6. Emission Analysis
7. Transmission
8. Electronic Fuel Injection
9. Carburettor
10. Fuel Injection Pump
11. Phasing and Calibration
12. Engine Cooling System
13. Engine Lubrication System
14. Brake
15. Tuning of Engine
16. Electrical System
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-446 Computer Aided Engineering
Credit Hours: 1-2
Contact Hours: (1, 2)

3. Pro-E Training Guide, Parametric Technologies
4. The Finite Element Method in Mechanical Design, Knight, PWS Kent, 1993

Grading: As per NUST statutes.

Course Learning Outcomes:
To be defined before the next time when the course will be offered.

Details of Syllabus
1. Introduction to use of modelling methods using computers.
2. Introduction to Analysis, Simulation and Synthesis methods.
3. Implementation of Numerical Techniques for solution of mathematical models (using MATLAB)
4. Parametric, Feature based, associative 3D Solid Modelling (using Pro/Engineer)
5. Analysis of Multi-body Dynamic Systems (using Pro/Mechanism and MSC.ADAMS)
6. Introduction to Design Optimization (using Pro/Engineer)
7. Theory of Finite Element Methods
8. Solution of mechanical engineering problems using FEM (using ANSYS)
### NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

**Subject:** ME-48 Internal Combustion Engines  
**Credit Hours:** 3-0  
**Contact Hours:** (3, 0)  
**Text Book(s):**  
**Reference Book(s):**  

**Grading:** As per NUST statutes.  

**Course Learning Outcomes:**

<table>
<thead>
<tr>
<th>No.</th>
<th>CLO</th>
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<th>Level of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Students will demonstrate knowledge of the operating characteristics of common IC engines and the ability to perform thermodynamic analysis on them.</td>
<td>PLO3</td>
<td>C4</td>
</tr>
<tr>
<td>2</td>
<td>Students will demonstrate knowledge of common fuels, the ability to analyse their combustion and an understanding of emissions.</td>
<td>PLO3</td>
<td>C4</td>
</tr>
<tr>
<td>3</td>
<td>Students will demonstrate knowledge of actual combustion cycle and the ability to analyze fuel-air cycles.</td>
<td>PLO3</td>
<td>C4</td>
</tr>
</tbody>
</table>

**Details of Syllabus**

1. Introduction to IC Engines  
2. Air Standard cycles for IC engines  
3. Engine design & operating parameters  
5. Thermo-chemistry of Fuel / Air mixtures  
6. Fuel Metering in SI & CI engines  
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-462 Power Plant Engineering
Credit Hours: 3-0
Contact Hours: (3, 0)

Reference Book(s): 1. Power Plant Engg., G. R. Nagpal
2. Power Plant Engg, F. T. Mouse

Grading: As per NUST statutes.

Course Learning Outcomes:
To be defined before the next time when the course will be offered.

Details of Syllabus

1. Steam Power Plant Cycles
2. Non-ideal Rankine cycle with superheat and reheat
3. Use of feed water heaters with steam power plants
4. Gas turbine power plant and related cycles
5. Brayton Cycle with regeneration, intercooling and reheat
6. Actual Brayton Cycle
7. Jet Propulsion
8. Compressor & Turbine efficiencies
9. Nuclear power plants
10. PWR, BWR, AGCR, FBR
11. Economic Analysis of Power Plants
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: ME-464 Renewable Energy Technologies
Credit Hours: 3-0
Contact Hours: (3, 0)

Reference Book(s): 1. PV Technologies & their Applications by Martin & Green

Grading: As per NUST statutes.

Course Learning Outcomes:
To be defined before the next time when the course will be offered.

Details of Syllabus

1. Introduction
2. Solar Energy PV
3. Solar Thermal Energy
4. Wind Energy
5. Hydropower
6. Bioenergy
7. Energy management
8. Geothermal energy
9. Fuel Cells
Subject: ME-460 Gas Turbines
Credit Hours: 3-0
Contact Hours: (3, 0)

Grading: As per NUST statutes.

Course Learning Outcomes:

<table>
<thead>
<tr>
<th>No</th>
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<th>PLO</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To enable students to apply laws of thermodynamics on Gas turbine power plants.</td>
<td>PLO 2</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>To prepare students to carry out thermodynamic analysis of Gas turbine power plants.</td>
<td>PLO 2</td>
<td>C4</td>
</tr>
<tr>
<td>3</td>
<td>To develop ability to investigate and conclude results from the analysis of the Gas turbine power plants.</td>
<td>PLO 4</td>
<td>C5</td>
</tr>
</tbody>
</table>

Details of Syllabus

1. Introduction
2. Cycle analysis
3. Jet propulsion cycle and analysis
4. Turbomachinery
5. Combustion chamber
6. Performance prediction of simple gas turbines
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: DME-475 Logistics and Inventory Management

Credit Hours: 3-0
Contact Hours: (3, 0)

2. Periodic Review Inventory Systems” by T. Wensing

Reference Book(s): 1. Lean logistics by Michael Boudin

Grading: As per NUST statutes.

Course Learning Outcomes:

To be defined before the next time when the course will be offered.

Details of Syllabus

1. Introduction to Logistics Systems
2. Forecasting Logistics Requirements
3. Designing the Logistics Network
4. Solving Inventory Management Problems
5. Case Study Organisation
6. Designing and Operating a warehouse
7. Lean Logistics
8. Logistics and Inventory management country perspective: Pakistan
9. International Logistics and its impact on Inventory management
10. Global Supply chain networks
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: DME-478 Production Planning and Control
Credit Hours: 3-0
Contact Hours: (3, 0)
Text Book(s): 1. Analysis and Control of Production Systems by E. Elsayed and T. Boucher
2. The Management of Manufacturing by Edward J. Andrson

Reference Book(s): 1. Practical Batch Process Management by Mike Barker
2. How to implement Lean Manufacturing by Lonnie Wilson

Grading: As per NUST statutes.

Course Learning Outcomes:

To be defined before the next time when the course will be offered.

Details of Syllabus

1. Introduction to Production Planning
2. Production systems and Management
3. Sales Forecasting, Scheduling
4. Capacity Calculations
5. Layout Optimization & Line balancing
6. Lean manufacturing
7. Case Study Organisation
8. Agile Manufacturing
9. Batch, Job Shop, Mass production environments
10. Various tool employed to control production
11. Modern Production facilities