TO WHOM IT MAY CONCERN

BE Mechanical program is being offered in NUST School of Mechanical and Manufacturing Engineering, Islamabad with effect from September 2009. List of semester wise courses of the program is attached. Detailed curriculum of each course is available on SMME’s official website page: http://www.nust.edu.pk/INSTITUTIONS/Schools/SMME/Pages/Download_Details.aspx?DocID=19&category=For%20Students

Dr. Abdul Ghafoor
Principal
SMME, NUST – Islamabad.
Email: principal@smme.nust.edu.pk
Contact Number: +925190856001
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BE Mechanical Engineering

Curriculum
For Fall 2015 to Fall 2017 Entries

School of Mechanical and Manufacturing Engineering, SMME-NUST, Islamabad
## Uniform Curriculum of Mechanical Engineering

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<th>Credits</th>
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<tbody>
<tr>
<td>ME-314</td>
<td>Control Systems</td>
<td>3-0</td>
</tr>
<tr>
<td>ME-421</td>
<td>Mechanical Vibrations</td>
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<tr>
<td>ME-410</td>
<td>Vibrations &amp; Controls Lab</td>
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<tr>
<td>ME-448</td>
<td>Internal Combustion Engines</td>
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<td>XX-4XX</td>
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<td>XX-4XX</td>
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<td>ME-499</td>
<td>Final Year Project</td>
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<tr>
<td>CSL-421</td>
<td>Community Service Learning</td>
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Total: 15-4=18-2*

*CSL-401 1-1 is not counted towards CGPA calculation

Total Credit Hours = 136-2*
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<tr>
<td>ME-440</td>
<td>Fundamentals of Aerodynamics</td>
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<td>ME-441</td>
<td>Applied Heat Transfer</td>
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<tr>
<td>ME-442</td>
<td>Applied Thermodynamics</td>
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<td>ME-443</td>
<td>Automotive Technology</td>
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<td>ME-444</td>
<td>Basic Naval Architecture</td>
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<td>ME-445</td>
<td>Computational Fluid Dynamics</td>
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<tr>
<td>ME-446</td>
<td>Computer Aided Engineering</td>
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<td>ME-447</td>
<td>Computer Aided Thermal System Design</td>
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<tr>
<td>ME-449</td>
<td>Introduction to Oil and Natural Gas Engineering</td>
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<td>ME-450</td>
<td>Laser &amp; its applications</td>
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<td>ME-451</td>
<td>Marine Environment Issues</td>
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<td>ME-452</td>
<td>Optimization Techniques</td>
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<td>ME-453</td>
<td>Power Generation and Distribution</td>
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<td>ME-454</td>
<td>Electrical Machines</td>
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<td>ME-455</td>
<td>Energy Conversion and Power Electronics</td>
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<td>ME-456</td>
<td>Engine Tribology</td>
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<td>ME-457</td>
<td>FEM applications in Automobile</td>
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<td>ME-458</td>
<td>Finite Element Methods</td>
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<td>Gas Dynamics</td>
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<td>ME-460</td>
<td>Gas Turbines</td>
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<td>ME-482</td>
<td>Advanced Engineering Design</td>
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<td>ME-461</td>
<td>Fuel Cell Technology</td>
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<td>ME-462</td>
<td>Power Plant Engineering</td>
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<td>ME-463</td>
<td>Power System Analysis</td>
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<td>ME-464</td>
<td>Renewable Energy Technologies</td>
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<td>ME-465</td>
<td>Robotics and Automation</td>
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<td>ME-466</td>
<td>Ship Propulsion Engineering</td>
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<td>ME-467</td>
<td>Solar Energy Systems</td>
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<td>ME-468</td>
<td>Vehicle Design Performance</td>
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<td>M&amp;S-401</td>
<td>Introduction to Modeling and Simulation</td>
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<td>RIME-221</td>
<td>Introduction to Mechatronics Design Fundamentals</td>
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<td>DME-470</td>
<td>Automotive Manufacturing Systems</td>
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<td>DME-471</td>
<td>Computer Applications in Automobile Manufacturing</td>
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<td>DME-472</td>
<td>Computer Applications in Manufacturing Systems</td>
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<td>DME-473</td>
<td>Industrial Maintenance Management</td>
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<tr>
<td>DME-474</td>
<td>Logic Design &amp; Micro-processors</td>
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<td>DME-475</td>
<td>Logistics and Inventory Management</td>
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<tr>
<td>DME-476</td>
<td>Ergonomics, Work Study and Methods Engineering</td>
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<td>DME-477</td>
<td>FEM applications in Manufacturing</td>
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<tr>
<td>ME-481</td>
<td>Vehicle Dynamics</td>
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<tr>
<td>ME-483</td>
<td>Power Train Systems</td>
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</table>
SEMESTER-I
Subject: **PHY-102 APPLIED PHYSICS**
Credit Hours: 2-1
Contact Hours: (2-3)

**Text Book:** Advanced Physics, Tom Duncan, Latest edition, Hodder Education Publishers,

**References:** Halliday & Resnick, Physics, Latest edition

**Goals:** To teach students about the fundamentals of applied engineering physics which includes. Light propagation inside different media and harmonic motions of particles.

**GRADING:** As per NUST statutes.

**Course Outline:**

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: MATH-105 CALCULUS & VECTOR ALGEBRA
Credit Hours: 3-0
Contact Hours: (3,0)
Text Book:

GRADING: As per NUST statutes.

Course Outline:
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, 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, Center of mass
11. Properties, Differential and Integration of Transcendental function
12. Indeterminate forms and L Hospital rule, trigonometric integrals.
14. Sequence & Series
Subject: EC-102 COMPUTER SYSTEMS & PROGRAMMING
Credit Hours: 1-2
Contact Hours: (1,6)
Text Books:
1) Turbo C Programming for the PC Robert Lafore

Reference Books:
Richard P. Halpern: C for Yourself, Oxford University Press, 1996

GRADING: As per NUST statutes.

Course Outline:
1) Introduction to Computers:
   - Computer components and systems
   - Networks
   - Operating Systems
2) Programming:
   - 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).
   - Data: Data types, data representation, identifiers, reserved words, variables, constants
   - Input and Output: Standard Library, output, address operator, input, string i/o, character i/o, escape sequences, assignment statement, type casting.
   - Operators: Arithmetic operators, operator precedence, associativity
   - Selection: Relational and logical operators, if, if/else, nested if’s, conditional operator, conditional expressions, switch.
   - Repetition: While, do/while, for(;;), break and continue statements.
   - Functions: Programmer defined functions, library functions, storage classes, scope, parameter passing, recursion.
   - Arrays: Input and output of data, searching, sorting, array of characters, arrays as parameters.
   - Structures: Structure declaration, accessing structure members, arrays of structures, passing structures as function arguments.
   - Pointers: Address and indirection operators, pointer arithmetic, pointers and arrays, call by value and call by reference, dynamic memory allocation.
   - Files: Opening and closing files, reading and writing text files.
   - Introduction to Object Oriented Programming: Classes, instantiation, member function, data members, constructors, destructors, function overloading, default arguments.
   - Introduction to Data Structures
Subject: HU-100 ENGLISH
Credit Hours: 2-0
Contact Hours: (2,0)
Text Books:

1. Functional English
   a) Grammar
   b) Writing
   c) Reading/Comprehension
   d) Speaking

Course Objectives: To enhance language skills and develop critical thinking

GRADING: As per NUST statutes.

Course Outline:

- Basics of Grammar
- Parts of speech and use of articles
- Sentence structure
- Active and passive voice
- Practice in unified sentence
- Analysis of phrase
- Clause and sentence structure
- Transitive and intransitive verbs
- Punctuation and spelling

Comprehension
Answers to questions on a given text

Discussion
General topics and every day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

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

Translation skills
Urdu to English

Paragraph writing
Topics to be chosen at the discretion of the teacher

Presentation skills
Introduction
Note: Extensive reading is required for vocabulary building
Subject: **HU-101 ISLAMIC STUDIES**  
Credit Hours: 2-0  
Contact Hours: (2,0)  

**Text Book:** Islamic Education by A.S. Bukhari & M. D Zafar  
**References:** Muslim’s Character by M. Alghazali  

**GRADING:** As per NUST statutes.

**Course Outline:**  
Subjective Study of the Holy quran and Hadith  
1. The meaning of Islam  
2. *Ibadaat* (Worship)  
3. Amr Bll Baroof wa Nabi anll Munkir (Commands and Prohibition)  
4. Unity of Ummah  
5. Kasb-I-Halal (Lawful Earning)  
6. Fundamental Human Rights;  
7. Relation with Non-Muslims  
Holy Prophet - As a Model of excellence  
The System of Morality Development  
Islamic Civilization
Subject : ME-110 ENGINEERING DRAWING AND GRAPHICS
Credit Hours : 1-1
Contact Hours : 01 (Theory)+ 03 (Prac.) per week.
Text Book : 1. First Year Engineering Drawing by A. C. Parkinson
Reference Book : 1. Engineering Drawing and Design by Cecil Jensen
                 And Jay D. Helsel
                 2. Engineering Graphics by Craft Meyer and Boyer
Pre Requisite : Basics of Geometrical Drawing
Mode of Teaching : Lectures / Practicals
GRADING: As per NUST statutes.

Course Outline

Part-1 Engineering Drawing
1. Types of lines and usage
2. Drawing Instruments and usage
3. Sheet Planning and Dimensioning
4. Orthographic projection, First and Third Angle
5. Sectional Drawing
6. Isometric Drawing
7. Assembly Drawing
8. Standard Part Drawing

Part-2 Graphical Drawing
1. Projection of points on different planes
2. Projection and Traces of lines
3. Projection and Traces of planes
4. Introduction to auxiliary and oblique planes and views
5. Loci of points and generated curves
6. Types of solids, development and projection of solids
7. Section of solids on principal and auxiliary planes
8. Introduction to intersection of solids and surfaces
9. Introduction to AutoCAD
SUBJECT: ME-121 WORKSHOP PRACTICE

CREDIT HOURS: 1-2

CONTACT HOURS: 1-6

TEXT BOOK:
1. W.A. Chapman, Workshop Technology, Part I & II

REFERENCE BOOK:
1. W.A. Chapman, Workshop Technology, Part III,

PREREQUISITE:
1. Class notes / Books
2. Shop safety, Protective Gowns, Hand Gloves, Safety Goggles, etc.

MODE OF TEACHING Lectures / Practical

GRADING: As per NUST statutes.

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,
SEMESTER-II
Subject: MATH-121 LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

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

References: a) Glyn James, Modern Engineering mathematics.

GRADING: As per NUST statutes.

Course Outline:

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.
   Introduction to Differential Equations., ODE of First order and first degree
6. ODEs of second and higher orders.
Subject: CH-101 APPLIED CHEMISTRY
Credit Hours: 2-1
Contact Hours: (2-3)


References: a) J.W Moore, W.G Davies: Collings: Chemistry  
b) M.Z Iqbal Chemistry for BSc  
c) G.R.V.Heeke; Karuiktic : Lasers in Chemistry  
d) M A Usmani Engineering Chemistry  
e) F Shumura, Semiconductors Silicon, Crystal Technology  
f) Brady, Russell, Hulum Chemistry for BSc

GRADING: As per NUST statutes.

Course Outline:

1 Electro Chemistry  
2 Corrosion and its Applications  
3 Chemistry of Engineering Materials  
4 High-Polymers  
5 Thermo chemistry  
6 Fuels  
7 Solution Chemistry
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: HU-107 PAKISTAN STUDIES
Credit Hours: 2-0
Contact Hours: (2.0)
Text Book: The Emergence of Pakistan, Chaudhry Muhammad Ali, University of the Punjab, Lahore, 1979
References: 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 Outline:

1. Genesis of Pakistan.
4. Pakistan in the Comity of Nations.
5. Social & Environmental Problems in Pakistan.
Subject: HU-109 COMMUNICATION SKILLS
Credit Hours: 2-0
Contact Hours: (2,0)

Text Books:

a) Read Better, Write Better – Reader’s Digest Compilation.
c) Steve M.Gerson/Sharon J. Gerson Technical Writing; Addison Wesley Longman (Singapore) Pte. Ltd.
d) Better Vocabulary by Edie Schwager.

GRADING: As per NUST statutes.

Course Outline:

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.

Reading Skills:

a. Structure of English Language  
b. Grammar and Syntax  
c. Skimming of gist of a Text  
d. Scanning for specific information  
e. Fast Reading  
f. Understanding of punctuation  
g. Understanding context  
h. Understanding the relationship between sentences and clauses in a text  
j. Recognizing the effects of style  
k. Making inferences

Presentation and listening skills:

a. Principles of Technical Communication  
b. Multimedia and Paper Presentations  
c. Presentation Practice by the students.
SUBJECT: ME-111 CAD
CREDIT HOURS: 1-1
CONTACT HOURS: 4 per week
M.A. Drum, Wildfire 2.0 fundamentals
GRADING: As per NUST statutes.

Course Outline:

Introduction

Geometric Modeling Systems


Introduction to modeling software e.g. Pro/E, Solid Edge/Works or as available.

Feature based designing of flat parts using CAD software

Introduction to CNC Tooling, Control Systems and Programming
SUBJECT: ME 112: ENGINEERING STATICS
CREDIT HOURS: 3-0
CONTACT HOURS: 3 per week
TEXT BOOK:
Engineering Mechanics – Statics, R. C. Hibbler
REFERENCE BOOK:

GRADING: As per NUST statutes.

Course Outline:

1. (a) Force Systems:
   (b) Moment

2. Equilibrium:

3. Structures:

4. Friction:

5. Centre of Gravity and Centroid:

6. Moments of Inertia:
SUBJECT: ME-130 THERMODYNAMICS-I
CREDIT HOURS: 3-0
CONTACT HOURS: 3 per week
PREREQUISITE: Lectures / Demonstrations
MODE OF TEACHING: As per NUST statutes.

Course Outline

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>INTRODUCTION</td>
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<td>2.</td>
<td>PROPERTIES OF PURE SUBSTANCES</td>
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<td>3.</td>
<td>FIRST LAW OF THERMODYNAMICS (Closed System)</td>
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<td>4.</td>
<td>FIRST LAW OF THERMODYNAMICS (Open System)</td>
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<td>5.</td>
<td>SECOND LAW OF THERMODYNAMICS</td>
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<td>SECOND LAW OF THERMODYNAMICS - ENTROPY</td>
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SEMESTER-III
Subject: MATH-241 VECTOR CALCULUS & PDE
Credit Hours: 3-0
Contact Hours: (3,0)


References: Borisenko & Taranov, Vector and Tensor Analysis with Applications.

Goals: To develop expertise in vector and tensor calculus.

GRADING: As per NUST statutes.

Course Outline:
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: ME-210 ENGINEERING DYNAMICS

CREDIT HOURS: 3-1

CONTACT HOURS: 3-3 per week

COURSE OBJECTIVES: To teach methods for predicting the behavior of dynamic mechanical systems


GRADING: As per NUST statutes.

Course Outline:

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
Statics

1. Objective: Verify the conditions of equilibrium when sets of parallel forces act in one plane on a rigid body $\sum F_v = 0$ (where $F =$ forces and $V =$ vertical)

2. Verify parallelogram law and equilibrium law & Show that for system of forces in equilibrium force polygon is close

3. Object of the experiment is to study equilibrium conditions for five forces in three dimensional system
   1. Concurrent forces
   2. Non-Concurrent forces

4. Measure the forces in loaded frame and then compare them with theoretical values using roof truss apparatus

Dynamics:

5. Test Flat, Vee and Round Belts with varying angles and lap around a pulley and compare the results with theoretical data using friction belt apparatus

6. To demonstrate variation of friction forces with mass, material, surface area and speed of travel of materials.

7. Investigate behavior of flat clutch plates and compare the results with theoretical values calculated from two different methods

8. To determine the coefficient of friction under static and sliding conditions between various materials and steel

9. Determine the frictional torque of plain bearings of different material and compare it with ball bearing
SUBJECT: ME-220 ENGINEERING MATERIALS
CREDIT HOURS: 3-0

CONTACT HOURS: (3, 0)

COURSE OBJECTIVES: To familiarize the students with engineering materials, their properties and applications.


GRADING: As per NUST statutes.

Course Outline:

1. Introduction to Materials background, development along the civilizations.
2. Materials for the Defense 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.
SUBJECT: ME-230 FLUID MECHANICS-I
CREDIT HOURS: 3 hours per week
CONTANT HOURS: 3 Hours per Week

MODE OF TEACHING: Lectures
GRADING: As per NUST statutes.

Course Outline:

<table>
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<tr>
<th>No.</th>
<th>Topics</th>
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<tr>
<td>1.</td>
<td>FLUID PROPERTIES:</td>
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<td>2.</td>
<td>FLUID STATICS:</td>
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<td>3.</td>
<td>KINEMATICS OF FLOW:</td>
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<td>4.</td>
<td>FLUID KINEMATICS:</td>
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<td>5.</td>
<td>EQUATION OF CONTINUITY, FLOW ENERGY EQUATION:</td>
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<td>6.</td>
<td>DIMENSIONAL ANALYSIS AND SIMILITUDE:</td>
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SUBJECT: ME-231 THERMODYNAMICS-II
CREDIT HOURS: 3-1
CONTACT HOURS 3-3 Hours per Week
PREREQUISITE: ME-130 THERMODYNAMICS-I
GRADING: As per NUST Statutes
OBJECTIVES: The students will learn about vapor power, gas power and refrigeration systems; details related to the combustion process as well as basics of non-reacting mixtures, turbines, compressors and pumps.

Course Outline:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1.</td>
<td>Review:</td>
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<tr>
<td>2.</td>
<td>Thermodynamic Property Relations:</td>
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<td>3.</td>
<td>Mixtures:</td>
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<tr>
<td>4.</td>
<td>Gas Power Cycles:</td>
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<tr>
<td>5.</td>
<td>Vapor and combined power cycles:</td>
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<tr>
<td>6.</td>
<td>Chemical Reactions and Equilibrium:</td>
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<tr>
<td>7.</td>
<td>Dynamic Machine Theory:</td>
</tr>
</tbody>
</table>

THERMODYNAMICS LAB
1. Boyle's Law demonstration (pressure x volume = K)
2. The expansion process of perfect gasses (Sudden Expansion) and use of clement and the Desermos method to find the value of "Y."
3. To study and perform different temperature measuring devices on the Temperature Measurement Bench
4. To demonstrate the Seebeck Thermo-Electric Effect
5. To demonstrate the relationship between the pressure and temperature of saturated steam in equilibrium in a Marct Boille
6. To determine the power input, heat output and coefficient of performance of a vapor compression Cycle in Mechanical Heat Pump
7. To plot the vapor compression cycle on the p-h diagram and compare with the ideal cycle in mechanical Heat pump
8. To perform energy balances for the condenser and compressor (Mechanical Heat Pump).
9. To estimate the effect of the compressor pressure ratio of volumetric efficiency (Mechanical Heat Pump).
10. Study of a gas turbine operation demonstration of its different components.
11. Determination of the compression ratio of the compressor.
13. Study of Steam power Plant components
14. To find fuel consumption, power generation and efficiencies for Boiler, Turbine, Condenser &
    Overall plant of Steam Power Plant (Test run with Generator & Lamp load)
15. To find fuel consumption, power generation and efficiencies for Boiler, Turbine, Condenser &
    Overall plant of Steam Power Plant (Test run with Prony Brake).
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: MATH-231 FOURIER & COMPLEX ANALYSIS
Credit Hours: 3-0
Contact Hours: (3,0)

GRADING: As per NUST statutes.

Course Outline:

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. Modeling 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
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Subject: EE-103 ELECTRICAL ENGINEERING
Credit Hours: 2-1
Contact Hours: (2,3)
Text Book:
1. Electric Circuits Fundamentals, Sergio Franco, OUP
4. Electric Circuits, Basic Electricity By Schaum’s Series

GRADING: As per NUST statutes.

Course Outline:

1) Introduction to DC Circuits:
   Series and parallel circuits,
   DC circuit analysis.
2) Theory of Alternating Current:
   Series and parallel circuits,
   Resistance, inductance and capacitance of AC circuits,
   Power factor,
   Resonance in RLC circuits,
   Single phase and poly-phase circuits,
   Power and power factor measurement,
   Current and voltage relationship in phase and line circuits,
   Types, characteristics and testing of AC motors,
   Motor starters and switch gears,
   Electric traction and braking,
   Solenoids.
3) Operational Amplifiers
4) Transformers:
   Voltage and current relationship of primary and secondary types of transformers,
   Losses and efficiency.
5) Generators and motors:
   Types, construction and characteristics,
   Motor starters,
   Testing and efficiency of machines.
Subject: HU-222 PROFESSIONAL ETHICS
Credit Hours: 2-0
Contact Hours: (2, 0)

Text Book:

GRADING: As per NUST statutes.

Course Outline:

Introduction
a. Definitions/Importance/Kinds-
b. Factors/Sources of Islamic Ethics
c. Islamic ethical system

Ethics in Business
a. Enforcement of ethical environment/Factors
c. Islamic rules for business
d. Lawful and unlawful behaviour in Islam

Engineering Ethics
a. Scope & Aims, Theories, responsibilities
b. IEEE code of Ethics
c. Ethical code for engineers
d. Ethical code for Software engineers

Moral Courage
a. Moral courage, its importance and how to improve?
b. Attributes of morally courageous leaders

Relevant Case Studies
To be decided by the instructor
Subject: HU-212 TECHNICAL & BUSINESS WRITING
Credit Hours: 2-0
Contact Hours: (2,0)

Text Book:
   b. Technical Writing by Steve M. Gerson.
   d. Technical Communication by Rebecca E. Burnett.

GRADING: As per NUST statutes.

Course Outline:

1. Technical Writing:
   * 7Cs of Tech Communication.
   * Mechanics of Tech Writing, Comparison & Contrast

2. Research Writing Skills:
   * Methodologies
   * Techniques, Review of Literature.
   * Research paper writing

3. Letter Writing:
   * Formal/Informal Letters

4. Professional & Business Writing:
   * Memorandum
   * Agenda Points – Notices
   * Minutes of a Conference/Meeting
   * Types of Tech Writing
   * Preparing Model Correspondence.
SUBJECT: ME-211 MECHANICS OF MATERIALS-I
CREDIT HOURS: 3-0
CONTACT HOURS: 3 per week
REFERENCE BOOKS:
PREREQUISITE: ME-112 Engineering Statics
GRADING: As per NUST statutes

Course Outline:

Topics
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
SUBJECT: ME-235 FLUID MECHANICS-II
CREDIT HOURS: 3-1 hours per week
CONTACT HOURS: 3-3 Hours per Week
MODE OF TEACHING: Lectures/Demonstrations
GRADING: As per NUST statutes.

Course Outline:

<table>
<thead>
<tr>
<th>No.</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FLOW IN PIPES AND DUCTS (INCOMPRESSIBLE INTERNAL FLOW):</td>
</tr>
<tr>
<td>2</td>
<td>BOUNDARY LAYER THEORIES:</td>
</tr>
<tr>
<td>3</td>
<td>DRAG AND LIFT (INCOMPRESSIBLE EXTERNAL FLOW):</td>
</tr>
<tr>
<td>4</td>
<td>OPEN-CHANNEL FLOW:</td>
</tr>
<tr>
<td>5</td>
<td>COMPRESSIBLE FLOW:</td>
</tr>
<tr>
<td>6</td>
<td>TURBO MACHINERY:</td>
</tr>
</tbody>
</table>

ME-235 FLUID MECHANICS LAB
1. To measure the volume flow rate at various valve positions using the volumetric tank of the hydraulic bench
2. To determine the density and specific gravity of a fluid and demonstrate the capillary effect that occur in various tubes and plates
3. To determine the viscosity of a fluid using falling sphere method and Viscometer
4. To measure the metacentric height of a floating body and determine its initial static stability
5. To experimentally locate the center of pressure of a vertical, submerged, plane surface
6. To study the characteristics of flow through both converging and diverging sections and demonstrate Bernoulli’s theorem.
7. To determine the discharge coefficient of a venture meter and measure flow rate
8. To demonstrate transition from laminar to turbulent flow using the Osborne Reynolds demonstration unit and determine Reynolds number of flow.
9. To measure the force developed by a jet of water deflected on a fixed impact object by comparing it to the force predicted by the moment theory.
10. To study the fluid friction head losses which occur when an incompressible fluids flows through valves and pipe flow metering devices.
11. To measure losses in pipe fittings related to flow rate and calculate loss coefficient related to velocity head.
12. To measure losses in gate valves related to flow rate and calculate loss coefficient related to velocity head.
13. To determine the performance characteristics of a pelton wheel hydraulic turbine and present the torque and power as a function of a turbine speed.
14. To study the characteristics of a single pump and multi pumps connected in series and in parallel, with varying flow rates and pump speed.
Subject: MATH-361 PROBABILITY & STATISTICS
Credit Hours: 3-0
Contact Hours: (3,0)


Goal: To teach students basics of probability and statistics with applications.

GRADING: As per NUST statutes.

Course Outline:
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
3. Introduction to theory of Probability, Theorems of Probability, Conditional probability
4. Permutations and Combinations
5. Random Variables and Probability Distributions
6. Mean and Variance of a Distribution, Expectation, Moments
7. Binomial, Poisson & Hypergeometric distributions
8. Normal distribution
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
14. Acceptance sampling, errors & rectification
15. Goodness of Fit, Chi-square test, Curve fitting
16. Regression Analysis, Curve Fitting
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

**SUBJECT**
ME-310 MECHANICS OF MATERIALS-II

**CREDIT HOURS**
3-1

**CONTACT HOURS**
3-3 PER WEEK

**COURSE OBJECTIVES**

- a. To understand shear force and bending moment in beams.
- b. To develop the concept of stress and strain.
- c. To analyze determinate and indeterminate beams.
- d. To understand concepts of stress concentration, fatigue, creep, fracture etc.

**TEXT BOOK**

**REFERENCE BOOK**

**PREREQUISITE**
Mechanics of Materials I

**MODE OF TEACHING**
Lectures

**GRADING**
As per NUST statutes

**Course Outline:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transformation of Stresses and Strains:</td>
</tr>
<tr>
<td>2</td>
<td>Principal Stresses and Strains, Mohr’s Circles, Stresses on Oblique Planes – Principal Stresses:</td>
</tr>
<tr>
<td>3</td>
<td>Theories of Failure for Solids:</td>
</tr>
<tr>
<td>4</td>
<td>Thick-walled Cylinders:</td>
</tr>
<tr>
<td>5</td>
<td>Bending of Beams:</td>
</tr>
<tr>
<td>6</td>
<td>Buckling of Columns:</td>
</tr>
<tr>
<td>7</td>
<td>Rotating Cylinders and Disks:</td>
</tr>
<tr>
<td>8</td>
<td>Basic Contact Mechanics:</td>
</tr>
</tbody>
</table>
No.  Topics
1  **Transformation of Stresses and Strains:**

2  **Principal Stresses and Strains, Mohr’s Circles, Stresses on Oblique Planes – Principal Stresses:**

3  **Theories of Failure for Solids:**

9.  **Unsymmetrical Bending:**

**Mechanics of Materials-II**

1. To experimentally demonstrate Shearing force is the algebraic sum of the transverse components of the forces to one side of the section & Bending moment is the algebraic sum of forces to either side of the section

2. To experimentally determine the deflection of frame when subjected to horizontal loading

3. Determine and compare the modulus of rigidity for different materials.

4. Determine the modulus of elasticity of different materials.

5. To demonstrate unsymmetrical bending of beams

6. Investigate the relationship between the deflections and applied loads and the effect of variations in length and cross sectional dimensions on beam deflection.

7. Photoelastic Experiments with mechanical mode

8. Demonstrates the three dimensional stress state in a thick walled vessel under internal pressure

9. Perform Material Testing and study of Tensile testing and Brinell hardness testing
SUBJECT: ME-221 MANUFACTURING PROCESSES

CREDIT HOURS: 3-0

CONTACT HOURS: 3 Hours per week

TEXT BOOK:
   Begeman, 8th Edition, Wiley; 1987

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

COURSE OBJECTIVE: To give the understanding of manufacturing processes, this includes the foundry practice, conventional and non-conventional machining processes material properties and quality control.

GRADING: As per NUST statutes.

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 molding, spinning etc
7. Bulk Deformation processes (Drawing, extrusion, sheet metal)
SUBJECT: ME-312 MEASUREMENT & INSTRUMENTATION
CREDIT HOURS: 2-0
CONTACT HOURS: 2 Hours per Week
TEXT BOOK:
Electronic Instrumentation and Measurements David A. Bell

REFERENCE BOOKS:
Labview for Engineers Jeffrey Travis and Jim Kring

GRADING: As per NUST statutes.

Course Outline:
Introduction Instruments for measurement of mechanical engineering quantities (length, force, torque, frequency, pressure, flow, and temperature etc.)

Details
- Pressure Measurement:
- Flow Measurement:
- Temperature Measurement:
- Strain Gages:
- Data Acquisition and Processing:
- Virtual Instrumentation:
LIST of EXPERIMENTS

10. Positional Resistance Transducers
11. Wheatstone Bridge Measurements
12. Temperature Measurement using NTC thermistors and Type K Thermocouple
13. Temperature Measurement using Temperature measuring IC and Platinum RTD
14. Introduction to LABVIEW
SUBJECT: ME-325 ENGINEERING ECONOMICS

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


References: Samuels on, “Economics”

Goals: To familiarize the students with the basic concepts of money management.

GRADING: As per NUST statutes.

Course Outline:

2. Type of Costs - Time value of money, Taxes, Cash Flow Diagrams.  
   Investment and Replacement Analysis  
   Project Feasibility Analysis, Setting MARR, Type of Investments, Equity vs. Debt Financing, 
   Depreciation Accounting,  
   Taxes and Inflation,  
   Introduction to Balance sheet and financial statements.
3. Corporate Economics
# EE-212 BASIC ELECTRONICS

**Subject:** EE-212 BASIC ELECTRONICS  
**Credit Hours:** 2-1  
**Contact Hours:** (2,3)  
**Text Book:**  

**GRADING:** As per NUST statutes.  

## Details of Syllabus

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Semiconductor Theory &amp; Electronics Fundamentals</td>
</tr>
<tr>
<td>2</td>
<td>Diodes and its applications</td>
</tr>
<tr>
<td>3</td>
<td>Special Purpose Diodes</td>
</tr>
<tr>
<td>4</td>
<td>Bipolar Junction Transistors, Transistor Modeling, Field Effect Transistors</td>
</tr>
<tr>
<td>5</td>
<td>Number systems, Boolean Algebra, gates.</td>
</tr>
<tr>
<td>6</td>
<td>Combinational logic (adders, comparators, decoders, multiplexers, etc.)</td>
</tr>
<tr>
<td>7</td>
<td>Sequential logic (flip-flops, registers, counters, ROM, PROM, EPROM).</td>
</tr>
<tr>
<td>8</td>
<td>Microprocessors (registers; ALU; CU; memory, address, data and control buses).</td>
</tr>
<tr>
<td>9</td>
<td>ADC and DAC, Micro-controllers.</td>
</tr>
</tbody>
</table>
SEMESTER-VI
Subject: MATH-351 NUMERICAL METHODS
Credit Hours: 03
Contact Hours: (3,0)
References:
   a) Curtis F. Gerald Patrick O. Wheatley: Applied Numerical Analysis, Addison-Wesley
   b) Donald Greenspan & Vincenzo Casulli: Numerical Analysis For Applied Mathematics, Science, and Engineering, Addison-Wesley
   c) David Kahaner: Numerical Methods and Software, Prentice Hall.

GRADING: As per NUST statutes.

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-420 PROJECT MANAGEMENT
CREDIT HOURS: 2-0
Contact Hours: (2,0)
TEXT BOOK:
3. Project Management by Harold Kerzner
REFERENCE BOOK:
1. Modern Production and Operation Management by Elwood S. Buffa
2. Operation Management by Roger G. Schroeder
MODE OF TEACHING: Lectures
GRADING: As per NUST statutes.

Course Outline

- Project Planning and Scheduling
- Gantt charts, PERT and CPM
- Software on Project Management
- Work Breakdown Structure (WBS)
- Request for Proposal (RFP)
- Project management
- Case Studies
SUBJECT: ME-311 MACHINE DESIGN

CREDIT HOURS: 3-0

CONTACT HOURS: 3 Hours per Week


GRADING: As per NUST statutes.

DETAILS OF SYLLABUS

Screws, Keys and Couplings:

Welded & Riveted Joints:

Mechanical Springs:

Bearings:

Shafts:

Clutches, Brakes, Couplings & Flywheels:

Flexible Mechanical Elements:

Gears and Gear Trains:

Miscellaneous Topics such as Flexible Mechanical Elements
SUBJECT: ME-315 MECHANICS OF MACHINES
CREDIT HOURS: 2-1
CONTACT HOURS: 2-3 per week
GRADING: As per NUST statutes.

Course Outline:

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-330 HEAT AND MASS TRANSFER**

### CREDIT HOURS:
3-0

### CONTACT HOURS:
3 Hours per Week

### TEXT BOOK:

### REFERENCE BOOK:

### PREREQUISITE:
Thermodynamics I.

### GRADING:
As per NUST statutes.

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### Course Outline:

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<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>INTRODUCTION</td>
</tr>
<tr>
<td>2</td>
<td>CONDUCTION HEAT TRANSFER</td>
</tr>
<tr>
<td>3</td>
<td>FREE AND FORCED CONVECTION</td>
</tr>
<tr>
<td>4</td>
<td>FREE CONVECTION</td>
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<tr>
<td>4</td>
<td>RADIATION:</td>
</tr>
<tr>
<td>5</td>
<td>HEAT TRANSFER WITH CHANGE OF PHASE:</td>
</tr>
<tr>
<td>6</td>
<td>HEAT EXCHANGERS</td>
</tr>
<tr>
<td>7</td>
<td>MASS TRANSFER:</td>
</tr>
</tbody>
</table>
SUBJECT: ME-331 REFRIGERATION AND AIR CONDITIONING
CREDIT HOURS: 3-0
CONTACT HOURS: 3 per week

REFERENCE BOOKS:

PREREQUISITE:
Thermodynamics-II

MODE OF TEACHING: Lectures/Lab
GRADING: As per NUST statutes.

Course Outline:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>INTRODUCTION to Air conditioning and Refrigeration</td>
</tr>
<tr>
<td>2.</td>
<td>REFRIGERANTS AND COMPONENTS</td>
</tr>
<tr>
<td>3.</td>
<td>REFRIGERATION CYCLES</td>
</tr>
<tr>
<td>4.</td>
<td>PSYCHROMETRY AIR-CONDITIONING</td>
</tr>
<tr>
<td>5.</td>
<td>HEATING AND COOLING LOAD CALCULATION - HUMAN COMFORT</td>
</tr>
<tr>
<td>6.</td>
<td>AIR TRANSMISSION, DISTRIBUTION AND SYSTEM DESIGN</td>
</tr>
<tr>
<td>7.</td>
<td>WATER TRANSMISSION, DISTRIBUTION AND SYSTEM DESIGN</td>
</tr>
</tbody>
</table>
SUBJECT: ME-332 HEAT TRANSFER & HVAC LAB
CREDIT HOURS: 0-1
CONTACT HOURS: 3 per week

DETAILED SYLLABUS

1. Fourier’s Law study of linear conduction of heat along a homogeneous bar.
2. Conduction of heat and overall heat transfer along a composite bar.
3. The effect of a change in cross-sectional area on the temperature profile along a thermal conductor.
4. The influence of thermal insulation upon the conduction of heat between adjacent metals.
5. Demonstration of the relationship between power input and Surface temperature in free and forced convection.
6. Demonstration of the use of extended surfaces to improve heat transfer from the surface and to determine the temperature distribution along an extended surface.
8. Demonstration of the STEFAN-BOLTZMANN LAW.
9. Global energy balance in the exchanger and losses study in concentric tube heat exchanger and shell & Tube Heat Exchanger
10. Study of the heat transfer in countercurrent and parallel flow conditions concentric tube heat exchanger and shell & Tube Heat Exchanger
11. Observation of the components and operation of an absorption refrigerator and Measurement of the performance of the absorption refrigerator under load
12. Demonstration of the vapor compression refrigeration cycle or heat pump cycle on visual cycle refrigerator
13. Estimate of the global heat transfer coefficient between the SES-36 coolant and water in Visual cycle refrigerator
16. Layout of the Steam Compression Cycle in a Diagram P-H and Comparison with the Ideal Cycle. Water as Heat Source and Air as Heat Source
SEMESTER-VII
SUBJECT: ME-314 CONTROL SYSTEMS
CREDIT HOURS: 3-0
CONTACT HOURS: 3 per Week

R.T Stefani, et al., Feedback Control systems, Feedback and Control Systems, Schaum’s Series, Feedback Control systems by Norman Nise, Modern

MODE OF TEACHING: Lectures/ Discussions

GRADING: As per NUST statues.

COURSE OUTLINE:

<table>
<thead>
<tr>
<th>No.</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Control Systems:</td>
</tr>
<tr>
<td>2</td>
<td>Mathematical models of systems:</td>
</tr>
<tr>
<td>3</td>
<td>Feedback control system – characteristics and performance, Test input signals:</td>
</tr>
<tr>
<td>4</td>
<td>The Root Locus Method:</td>
</tr>
<tr>
<td>5</td>
<td>Frequency Response Method:</td>
</tr>
<tr>
<td>6</td>
<td>State space method:</td>
</tr>
</tbody>
</table>
SUBJECT: ME-421 MECHANICAL VIBRATIONS
CREDIT HOURS: 3-0
CONTACT HOURS: 3 Hours per Week

Reference Book

GRADING: As per NUST statutes.

COURSE OUTLINE:

<table>
<thead>
<tr>
<th>No.</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fundamental concepts:</td>
</tr>
<tr>
<td>2.</td>
<td>Free vibration of SDOF systems:</td>
</tr>
<tr>
<td>3.</td>
<td>Harmonically excited SDOF systems:</td>
</tr>
<tr>
<td>4.</td>
<td>SDOF systems excited by general forcing functions:</td>
</tr>
<tr>
<td>5.</td>
<td>2DOF Systems:</td>
</tr>
<tr>
<td>6.</td>
<td>Introduction to MDOF systems:</td>
</tr>
<tr>
<td>7.</td>
<td>Numerical Methods for Natural Frequencies and Mode Shapes:</td>
</tr>
</tbody>
</table>
Mechanical Vibrations

1. Pendulum
2. 1 – Degree of Freedom Free Vibration
3. 1 Degree of Freedom Harmonic Excitation
4. Frequency Response
5. Unbalance Experiment
6. Base Excitation
7. Logarithmic Decrement

Controls LAB

1. Introduction to MATLAB its functions and applications
2. Introduction to MATLAB its functions and applications Plotting, Curve Fitting (Part-II)
3. Introduction to some MATLAB,s control functions-I
4. Introduction to some MATLAB,s control functions-II
5. Analysis to the response of the system
6. Introduction to Some Basic Application of SIMULINK
7. Root Locus Analysis
SUBJECT: ME-448 INTERNAL COMBUSTION ENGINES

CREDIT HOURS: 2-1

CONTACT HOURS: 2-3 Hours per Week


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 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>

Course Outline:

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

Testing and performance of the engine and exhaust analysis.
SEMESTER-VIII
SUBJECT: MGT-271 ENTREPRENEURSHIP

CREDIT HOURS: 2-0

CONTACT HOURS: 2-0 Hours per Week

TEXT BOOK:
2. S.S. Khanka, Entrepreneurial Development
4. Bruce A. Kirchhoff, Entrepreneurship and Dynamic Capitalism

MODE OF TEACHING: Lectures

GRADING: As per NUST statutes.

DETAILS OF SYLLABUS

- Evolution of the concept of entrepreneur, Characteristics of an entrepreneur, Distinction between an entrepreneur and a Manager, in Economic Development, Factors affecting entrepreneurial growth (economic, Non-Economic and Government factors). E-Commerce and business start-up and growth.

- 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 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, Analyzing the environmental situation and the market opportunity, Setting marketing objective, Formulating a marketing strategy.


- Product planning and development process. Creating parallel competition by developing a similar product or service, Product life cycle.