

National University of Sciences & Technology (NUST)  
School of Mechanical and Manufacturing Engineering (SMME)

No.0999/25/ACAD/SMME

28 Apr, 2017

## 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\\_Detail\\_s.aspx?DocID=19&category=For%20Students](http://www.nust.edu.pk/INSTITUTIONS/Schools/SMME/Pages/Download_Detail_s.aspx?DocID=19&category=For%20Students)

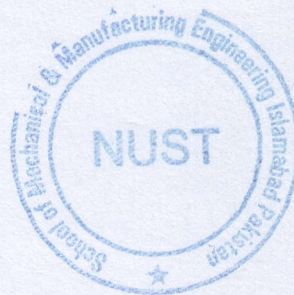
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Principal

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# Curriculum of BE Mechanical

Semester I			Semester II		
Course No	Course Title	Credits	Course No	Course Title	Credits
PHY-102	Applied Physics	2-1	MATH-121	Linear Algebra & ODEs	3-0
MATH-105	Calculus & Vector Algebra	3-0	CHE-101	Applied Chemistry	2-1
CS-102	Computer Systems & Programming	2-2	HU-101	Islamic Studies	2-0
HU-100	English	2-0	HU-107	Pakistan Studies	2-0
ME-122	Engineering Drawing & Graphics	1-1	ME-111	CAD	1-1
ME-121	Workshop Practice	1-2	ME-112	Engineering Statics	3-0
			ME-130	Thermodynamics-I	3-0
	<b>Total</b>	<b>11-6</b>		<b>Total</b>	<b>16-2</b>
Semester III			Semester IV		
Course No	Course Title	Credits	Course No	Course Title	Credits
MATH-241	Vector Calculus & PDEs	3-0	MATH-231	Fourier & Complex Analysis	3-0
HU-109	Communication Skills	2-0	EE-103	Electrical Engineering	2-1
ME-210	Engineering Dynamics	3-0	ME-211	Mechanics of Materials-I	3-0
ME-220	Engineering Materials	3-0	ME-221	Manufacturing Processes	3-0
ME-230	Fluid Mechanics – I	3-0	ME-222	Mechanics & Manufacturing Lab –I	0-1
ME-231	Thermodynamics- II	3-0	ME-233	Fluid Mechanics-II	3-0
ME-232	Thermodynamics Lab	0-1	ME-234	Fluid Mechanics Lab	0-1
	<b>Total</b>	<b>17-1</b>		<b>Total</b>	<b>14-3</b>
Semester V			Semester VI		
Course No	Course Title	Credits	Course No	Course Title	Credits
MATH-361	Probability & Statistics	3-0	MATH-351	Numerical Methods	3-0
HU-212	Technical and Business Writing	2-0	ME-313	Theory of Machines	3-0
ME-310	Mechanics of Materials-II	3-0	ME-314	Control Systems <sup>5</sup>	3-0
ME-311	Machine Design	3-0	ME-324	Engg Management & Economics	2-0
ME-312	Measurement & Instrumentation	2-0	ME-330	Heat & Mass Transfer	3-0
ME-323	Mechanics & Measurements Lab	0-1	ME-331	Refrigeration & Air Conditioning	3-0
EE-212	Basic Electronics	2-1	ME-332	Heat Transfer & HVAC Lab <sup>ss</sup>	0-1
				Internship (Pass/Fail basis)*	-
	<b>Total</b>	<b>15-2</b>		<b>Total</b>	<b>17-1</b>
Semester VII			Semester VIII		
Course No	Course Title	Credits	Course No	Course Title	Credits
ME-420	Project Management	2-0	HU-222	Professional Ethics	2-0
MGT-471	Entrepreneurship	2-0	XX-4XX	Elective –III	3-0
ME-421	Mechanical Vibrations	3-0	XX-4XX	Elective – IV	3-0
ME-410	Vibrations & Controls Lab	0-1	ME-499	Design Project	0-4
ME-422	Production Tooling & Automation	2-0			
ME-423	Mechanics & Manufacturing Lab –II	0-1			
XX-4XX	Elective – I	3-0			
XX-4XX	Elective – II	3-0			
ME-499	Design Project**	0-2			
	<b>Total</b>	<b>15-4</b>		<b>Total</b>	<b>8-4</b>

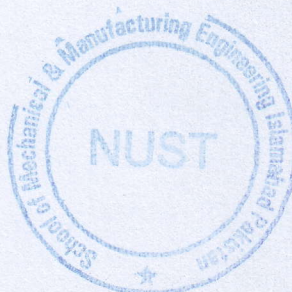
Total Credit Hours = 136





### List of Electives

ME-440	Fundamentals of Aerodynamics	3-0	ME-460	Gas Turbines	3-0
ME-441	Applied Heat Transfer	2-1	ME-461	Fuel Cell Technology	3-0
ME-442	Applied Thermodynamics	3-0	ME-462	Power Plant Engineering	3-0
ME-443	Automotive Technology	2-1	ME-463	Power System Analysis	3-0
ME-444	Basic Naval Architecture	3-0	ME-464	Renewable Energy Technologies	3-0
ME-445	Computational Fluid Dynamics	3-0	ME-465	Robotics and Automation	3-0
ME-446	Computer Aided Engineering	1-2	ME-466	Ship Propulsion Engineering	3-0
ME-447	Computer Aided Thermal System Design	2-1	ME-467	Solar Energy Systems	3-0
ME-448	Internal Combustion Engines	3-0	ME-468	Vehicle Design Performance	3-0
ME-449	Introduction to Oil and Natural Gas Engineering	3-0	M&S-401	Introduction to Modeling and Simulation	2-1
ME-450	Laser & its applications	3-0	RIME-221	Introduction to Mechatronics Design Fundamentals	2-1
ME-451	Marine Environment Issues	3-0	DME-470	Automotive Manufacturing Systems	3-0
ME-452	Optimization Techniques	3-0	DME-471	Computer Applications in Automobile Manufacturing	3-0
ME-453	Power Generation and Distribution	3-0	DME-472	Computer Applications in Manufacturing Systems	3-0
ME-454	Electrical Machines	3-0	DME-473	Industrial Maintenance Management	3-0
ME-455	Energy Conversion and Power Electronics	3-0	DME-474	Logic Design & Micro-processors	2-1
ME-456	Engine Tribology	3-0	DME-475	Logistics and Inventory Management	3-0
ME-457	FEM applications in Automobile	3-0	DME-476	Ergonomics, Work Study and Methods Engineering	3-0
ME-458	Finite Element Methods	3-0	DME-477	FEM applications in Manufacturing	3-0
ME-459	Gas Dynamics	3-0	ME-481	Vehicle Dynamics	3-0
ME-482	Advanced Engineering Design	3-0	ME-483	Power Train Systems	3-0







# 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**

Semester I			Semester II		
Course No	Course Title	Credits	Course No	Course Title	Credits
PHY-102	Applied Physics	2-1	MATH-121	Linear Algebra & ODEs	3-0
MATH-105	Calculus & Vector Algebra	3-0	CH-101	Applied Chemistry	2-1
EC-102	Computer Systems & Programming	1-2	HU-107	Pakistan Studies	2-0
HU-100	English	2-0	HU-109	Communication Skills	2-0
HU-101	Islamic Studies	2-0	ME-111	CAD	1-1
ME-110	Engineering Drawing & Graphics	1-1	ME-112	Engineering Statics	3-0
ME-121	Workshop Practice	1-2	ME-130	Thermodynamics-I	3-0
	<b>Total</b>	<b>12-6=18</b>		<b>Total</b>	<b>16-2=18</b>
Semester III			Semester IV		
Course No	Course Title	Credits	Course No	Course Title	Credits
MATH-241	Vector Calculus & PDEs	3-0	MATH-231	Fourier & Complex Analysis	3-0
ME-210	Engineering Dynamics	3-1	EE-103	Electrical Engineering	2-1
ME-220	Engineering Materials	3-0	HU-222	Professional Ethics	2-0
ME-230	Fluid Mechanics – I	3-0	HU-212	Technical and Business Writing	2-0
ME-231	Thermodynamics- II	3-1	ME-211	Mechanics of Materials-I	3-0
			ME-235	Fluid Mechanics-II	3-1
	<b>Total</b>	<b>15-2=17</b>		<b>Total</b>	<b>15-2=17</b>
Semester V			Semester VI		
Course No	Course Title	Credits	Course No	Course Title	Credits
MATH-361	Probability & Statistics	3-0	MATH-351	Numerical Methods	3-0
ME-310	Mechanics of Materials-II	3-1	ME-420	Project Management	2-0
ME-221	Manufacturing Processes	3-0	ME-311	Machine Design	3-0
ME-312	Measurement & Instrumentation	2-0	ME-315	Mechanics of Machines	2-1
ME-323	Manufacturing Processes & Instrumentation Lab	0-1	ME-330	Heat & Mass Transfer	3-0
ME-325	Engineering Economics	2-0	ME-331	Refrigeration & Air Conditioning	3-0
EE-212	Basic Electronics	2-1	ME-332	Heat Transfer & HVAC Lab	0-1
	<b>Total</b>	<b>15-3=18</b>		<b>Total</b>	<b>16-2=18</b>
Semester VII			Semester VIII		
Course No	Course Title	Credits	Course No	Course Title	Credits
ME-314	Control Systems	3-0	MGT-271	Entrepreneurship	2-0
ME-421	Mechanical Vibrations	3-0	XX-4XX	Elective –III	3-0
ME-410	Vibrations & Controls Lab	0-1	XX-4XX	Elective – IV	3-0
ME-448	Internal Combustion Engines	2-1	ME-499	Final Year Project II	0-4
XX-4XX	Elective-I	3-0	ME-498	Internship (Pass/Fail basis)	-
XX-4XX	Elective – II	3-0			
ME-499	Final Year Project	0-2			
CSL-421	Community Service Learning (Satisfactory/Participated basis)	1-1*			
	<b>Total</b>	<b>15-4=18-2*</b>		<b>Total</b>	<b>8-4=12</b>

**Total Credit Hours = 136-2\***

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

## **List of Electives For Fall 2015 to Fall 2017 Entries**

ME-440	Fundamentals of Aerodynamics	3-0		ME-461	Fuel Cell Technology	3-0
ME-441	Applied Heat Transfer	2-1		ME-462	Power Plant Engineering	3-0
ME-442	Applied Thermodynamics	3-0		ME-463	Power System Analysis	3-0
ME-443	Automotive Technology	2-1		ME-464	Renewable Energy Technologies	3-0
ME-444	Basic Naval Architecture	3-0		ME-465	Robotics and Automation	3-0
ME-445	Computational Fluid Dynamics	3-0		ME-466	Ship Propulsion Engineering	3-0
ME-446	Computer Aided Engineering	1-2		ME-467	Solar Energy Systems	3-0
ME-447	Computer Aided Thermal System Design	2-1		ME-468	Vehicle Design Performance	3-0
ME-449	Introduction to Oil and Natural Gas Engineering	3-0		ME-469	Production Tooling & Automation	2-1
ME-450	Laser & its applications	3-0		M&S-401	Introduction to Modeling and Simulation	2-1
ME-451	Marine Environment Issues	3-0		RIME-221	Introduction to Mechatronics Design Fundamentals	2-1
ME-452	Optimization Techniques	3-0		DME-470	Automotive Manufacturing Systems	3-0
ME-453	Power Generation and Distribution	3-0		DME-471	Computer Applications in Automobile Manufacturing	3-0
ME-454	Electrical Machines	3-0		DME-472	Computer Applications in Manufacturing Systems	3-0
ME-455	Energy Conversion and Power Electronics	3-0		DME-473	Industrial Maintenance Management	3-0
ME-456	Engine Tribology	3-0		DME-474	Logic Design & Micro-processors	2-1
ME-457	FEM applications in Automobile	3-0		DME-475	Logistics and Inventory Management	3-0
ME-458	Finite Element Methods	3-0		DME-476	Ergonomics, Work Study and Methods Engineering	3-0
ME-459	Gas Dynamics	3-0		DME-477	FEM applications in Manufacturing	3-0
ME-460	Gas Turbines	3-0		ME-481	Vehicle Dynamics	3-0
ME-482	Advanced Engineering Design	3-0		ME-483	Power Train Systems	3-0

# **SEMESTER-I**



## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**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.
3. Geometrical optics of spherical mirrors and refracting surfaces.
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**

<b>Subject:</b>	<b><u>MATH-105 CALCULUS &amp; VECTOR ALGEBRA</u></b>
<b>Credit Hours:</b>	3-0
<b>Contact Hours:</b>	(3,0)
<b>Text Book:</b>	1) Calculus, Earl W. Swokowski, Michael Olinick, Dennis Pence, Jeffery A. Cole, 6th Edition, Pws Pub Co, 1994 2) Calculus & Analytical Geometry, G.B. Thomas and R.L. Finney, 8th Edition, Addison-Wesley, 1992

**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.
6. Optimization Problems, velocity and Acceleration.
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.
13. Integrals of Rational, Improper integrals.
14. **Sequence & Series**



## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**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**  
2) C++ How to Program, Harvey M. Deitel, Paul J. Deitel, Third Edition, Prentice Hall. 2000  
3) Object-Oriented Programming in C++, Robert Lafore, Fourth Edition, Sams Publishers, 2001

### **Reference Books:**

Richard P. Halpern: C for Yourself, Oxford University Press, 1996  
B.J. Holmes: Programming with ANSI C, 1996, DP Publications

**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

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **HU-100 ENGLISH**

**Credit Hours:** 2-0

**Contact Hours:** (2,0)

**Text Books:** **1. Functional English**

a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492

2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

b) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 20-27 and 35-41.

c) Reading/Comprehension

1. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

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



## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**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

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

<b><u>Subject</u></b>	:	<b><u>ME-110 ENGINEERING DRAWING AND GRAPHICS</u></b>
<b><u>Credit Hours</u></b>	:	1-1
<b><u>Contact Hours</u></b>	:	01 (Theory)+ 03 (Prac.) per week.
<b><u>Text Book</u></b>	:	1. First Year Engineering Drawing by A. C. Parkinson 2. Geometrical Drawing by N. D. Bhatt.
<b><u>Reference Book</u></b>	:	1. Engineering Drawing and Design by Cecil Jensen And Jay D. Helsel 2. Engineering Graphics by Craft Meyer and Boyer
<b><u>Pre Requisite</u></b>	:	Basics of Geometrical Drawing
<b><u>Mode of Teaching</u></b>	:	Lectures / Practicals
<b><u>GRADING:</u></b>		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



# **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-121 WORKSHOP PRACTICE**

**CREDIT HOURS:** 1-2

**CONTACT HOURS:** 1- 6

**TEXT BOOK:** 1. W.A. Chapman, Workshop Technology, Part I& II  
Arnold Pub, Fifth Edition, Group 1989.

**REFERENCE BOOK:** 1. W.A. Chapman, Workshop Technology, Part III,  
Arnold Pub, Third Edition, Group 1989  
2. Any book of manufacturing processes.

**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**

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **MATH-121 LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS**

**Credit Hours:** 3-0

**Contact Hours:** (3,0)

**Text Book:** a) Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition, Wiley Publishers, 2011

**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.
7. Non-homogeneous linear differential equations.
8. System of linear differential equations.
9. Solution of ODEs using Laplace Transforms.



## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **CH-101 APPLIED CHEMISTRY**

**Credit Hours:** 2-1

**Contact Hours:** (2-3)

**Text Book:** Modern Physical Chemistry, G.F. Liptrot, J.J. Thompson, G.R. Walker, 4th Edition, Collins Educational Publishers, 1992.

**References:**

- a) J.W Moore, W.G Davices: Collings: Chemistry
- b) M.Z Iqbal Chemistry for BSc
- c) G.R.V.Heeke; Karuikstic : 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.**
2. **Development of Political & Constitutional System.**
3. **Economic Development in Pakistan.**
4. **Pakistan in the Comity of Nations.**
5. **Social & Environmental Problems in Pakistan.**
6. **Human Rights Issues.**

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **HU-109 COMMUNICATION SKILLS**  
**Credit Hours:** 2-0  
**Contact Hours:** (2,0)

**Text Books:**

- a) Read Better, Write better – Reader's Digest Compilation.
- b) Gliden H.K, Reports, Technical Writing, and Specifications; London, McGraw-Hill Book Company.
- 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.



# **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

<b><u>SUBJECT:</u></b>	<b><u>ME-111 CAD</u></b>
<b><u>CREDIT HOURS:</u></b>	1-1
<b><u>CONTACT HOURS:</u></b>	4 per week
<b><u>TEXT BOOK:</u></b>	G.R. Bertoline, E.M. Weibe, <i>Fundamentals of Graphics Communication</i> , 5 <sup>th</sup> edition, McGraw-Hill, New York
<b><u>REFERENCE BOOK:</u></b>	B. McFarlane, <i>Beginning AUTOCAD 2004</i> , 1 <sup>st</sup> edition, Elsevier M.A. Drum, <i>Wildfire 2.0 fundamentals</i>
<b><u>GRADING:</u></b>	As per NUST statutes.

## **Course Outline:**

### **Introduction**

#### **Geometric Modeling Systems**

Wire frame Modeling Systems, Surface Modeling Systems, Solid Modeling Systems: Modeling Functions, Data Structure, Euler Operations, Calculation of Volumetric Properties, Non-manifold Modeling, Assembly Modeling Capabilities: Basis Functions of Assembly Modeling, Browsing an Assembly, Features of Concurrent Design, Use of Assembly Models, Simplification of Assemblies. Rapid Prototyping.

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

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

<b><u>SUBJECT:</u></b>	<b><u>ME 112: ENGINEERING STATICS</u></b>
<b><u>CREDIT HOURS:</u></b>	3-0
<b><u>CONTACT HOURS:</u></b>	3 per week
<b><u>TEXT BOOK:</u></b>	Engineering Mechanics – Statics, R. C. Hibbler Engineering Mechanics: Volume 1: STATICS, J.L.Merriam & L.G. Kraige, 7 edition, Wiley, 2011
<b><u>REFERENCE BOOK:</u></b>	Vector Mechanics for Engineers, STATICS, 2 <sup>nd</sup> SI Metric Ed, By F.P. Beer and E.R. Johnston Jr.

**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:**

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

<b><u>SUBJECT:</u></b>	<b><u>ME-130 THERMODYNAMICS-I</u></b>
<b><u>CREDIT HOURS:</u></b>	3-0
<b><u>CONTACT HOURS:</u></b>	3 per week
<b><u>TEXT BOOK:</u></b>	Thermodynamics, An Engineering Approach, Cengel, Younus A., Boles, Micheal A., Latest Edition, McGraw Hill Inc,
<b><u>REFERENCE BOOK:</u></b>	“Fundamentals f Engineering Thermodynamics,” Moran Micheal J., John Wiley Inc Latest Edition.
<b><u>PREREQUISITE:</u></b>	
<b><u>MODE OF TEACHING:</u></b>	Lectures / Demonstrations
<b><u>GRADING:</u></b>	As per NUST statutes.

### **Course Outline**

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-III**

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **MATH-241 VECTOR CALCULUS & PDE**

**Credit Hours:** 3-0

**Contact Hours:** (3,0)

**Text Book:** Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition, Wiley Publishers, 2011

**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
3. Surfaces, Vector & Scalar functions and fields.
4. Curves, Tangents, Arc length of a curve.
5. Velocity, Acceleration, Curvature & Torsion of a curve.
6. Gradient of a Scalar Field and directional derivatives.
7. Divergence of a Vector Field
8. Curl. of a Vector Field
8. Gradient, Divergence and Curl in Curvilinear coordinates.
9. Line integral, integration around closed curves.
10. Application of double integrals, Green's theorem.
11. Tangent planes, Surface normal.
12. Surface integrals
13. Triple integrals, Divergence theorem of Gauss.
14. Application of the Divergence theorem, modeling of heat flow.
15. Stokes's theorem.
16. Solution of Partial differential equations

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**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

**TEXT BOOK:** Engineering Mechanics – Dynamics, R. C. Hibbler  
Engineering Mechanics: Volume 2: Dynamics, J.L.Merriam & L.G. Kraige, 7 edition, Wiley, 2012

**REFERENCE BOOK:** Vector Mechanics for Engineers, DYNAMICS, 2<sup>nd</sup> SI Metric Ed, By F.P. Beer and E.R. Johnston Jr.  
  
Engineering Mechanics: Dynamics by Anthony Bedford and Wallace Fowler. Addison-Wesley Publishing Company, Inc. 1995

**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
6. Planar Kinetics of a Rigid Body: Force & Acceleration
7. Introduction to Planar Kinetics of a Rigid Body: Work & Energy
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

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**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.

**TEXT BOOK:** Material Science and Engineering: An Introduction, William D. Callister Jr., 8th Edition, John Wiley & Sons, Inc. 2010

**REFERENCE BOOK:** Elements of Materials Science and Engineering by L. H. Van Vlack. World Student Series Edition, Addison-Wesley Publishing Company. 1989

**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
6. Introduction to Metals, Ceramics, Polymers and Composites.
7. Heat Treatments, Deformation, Recrystallization of Materials.
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.
13. Equilibrium Phase Diagrams and their industrial importance.
14. The Fe-Fe<sub>3</sub>C Equilibrium diagram.
15. Material's damaging modes during applications; Fracture, Fatigue, Wear etc.
16. Materials Testing; Tension Test, Hardness Test, Torsion Test, Fracture Mechanics, Fatigue, Brittle and Impact Testing . Testing of Materials, Standard codes; ASTM, BSI, 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 hours per week

**CONTANT HOURS** 3 Hours per Week

**TEXTBOOK:** Fundamentals of Fluid Mechanics, Bruce R, Munson, Donald F Young, Theodore H Okishi, 7th Edition, John Wiley & Sons Inc, 2012

**REFERENCE BOOK:** Fluid Mechanics, Frank M. White. McGraw Hill. Latest Edition.  
Fluid Mechanics, J. M. Cimbala Y. Cengel. McGraw Hill, Latest Edition.

**MODE OF TEACHING:** Lectures

**GRADING:** As per NUST statutes.

**Course Outline:**

No.	Topics
1.	<b>FLUID PROPERTIES:</b>
2.	<b>FLUID STATICS:</b>
3.	<b>KINEMATICS OF FLOW:</b>
4.	<b>FLUID KINEMATICS:</b>
5.	<b>EQUATION OF CONTINUITY, FLOW ENERGY EQUATION:</b>
6.	<b>DIMENSIONAL ANALYSIS AND SIMILITUDE:</b>

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

<b><u>SUBJECT:</u></b>	<b><u>ME-231 THERMODYNAMICS-II</u></b>
<b><u>CREDIT HOURS:</u></b>	3-1
<b><u>CONTANT HOURS</u></b>	3-3 Hours per Week
<b><u>TEXTBOOK:</u></b>	Thermodynamics, An Engineering Approach, Cengel, Younus A., Boles, Micheal A., Latest Edition, McGraw Hill Inc,
<b><u>REFERENCES:</u></b>	“Fundamentals of Engineering Thermodynamics”, Latest Edition, Michael J. Moran and Howard N. Shapiro, John Wiley Inc., “Applied Thermodynamics”, Latest Edition, T. D. Eastop and A. M. McConkey
<b><u>PREREQUISITE:</u></b>	ME-130 THERMODYNAMICS-I
<b><u>GRADING:</u></b>	As per NUST Statutes
<b><u>OBJECTIVES:</u></b>	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:**

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

### **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  $\gamma$ .
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 Marcet Boiler
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.
12. Calculation of gas turbine efficiency and specific fuel consumption.
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).

# **SEMESTER-IV**



## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **MATH-231 FOURIER & COMPLEX ANALYSIS**  
**Credit Hours:** 3-0  
**Contact Hours:** (3,0)  
**Text Book:** Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition, Wiley Publishers, 2011

**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.
4. Half range expansions, Complex Fourier series.
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
9. Heat Equation: its Solution by Fourier Series and Fourier Integrals
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
13. Power Series, Taylor Series, Laurent Series, Singularities, Zeros, Residue Integration Method

## **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
2. Electrical Power Technology 6<sup>th</sup> Edition By Theodore Wildi. Prentice Hall
3. Electric Machinery Fundamentals 4<sup>th</sup> Edition, PBy S. Chapman McGraw
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.

# **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **HU-222 PROFESSIONAL ETHICS**

**Credit Hours:** 2-0

**Contact Hours:** (2, 0)

**Text Book:** 1. Engineering Ethics, Concepts & Cases by C. Harris Words Worth, Islamic Education, 2000  
2. Islamic Education (Revised Edition 2002 by M. D. Zafar).

**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
- b. Principles & Decision Making.
- 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

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **HU-212 TECHNICAL & BUSINESS WRITING**

**Credit Hours:** 2-0

**Contact Hours:** (2,0)

- Text Book:**
- a. Reports, Technical Writing and Specifications, Glidon H.K, 1<sup>st</sup> edition, Mcgraw Hill Book Company, 2000
  - b. Technical Writing by Steve M. Gerson.
  - c. Reporting Technical Information by Kenneth W. Houpp, Thomas E. Pearsall, Tebeaux and Dragga Latest Edition.
  - 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.

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-211 MECHANICS OF MATERIALS-I**

**CREDIT HOURS:** 3-0

**CONTACT HOURS:** 3 per week

**TEXT BOOK:** Beer and Johnston, Mechanics of Materials, McGraw Hill, 1992. 4. R. R Craig, Mechanics of Materials, John Wiley, 2000.

**REFERENCE BOOKS:**

1. Mechanics of Materials, Russell C. Hibbeler, 8<sup>th</sup> Edition, Prentice Hall, 2010.
2. Benham and Crawford, Mechanics of Engineering Materials, ELBS, 1987
3. D. L. Logan, Mechanics of Materials, Harper Collins, 1991.

**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

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-235 FLUID MECHANICS-II**

**CREDIT HOURS:** 3-1 hours per week

**CONTANT HOURS** 3-3 Hours per Week

**TEXTBOOK:** Fundamentals of Fluid Mechanics, Bruce R, Munson, Donald F Young, Theodore H Okishi, 7th Edition, John Wiley & Sons Inc, 2012

**REFERENCE BOOK:** Fluid Mechanics, Frank M. White. McGraw Hill. Latest Edition.  
Fluid Mechanics, J. M. Cimbala Y. Cengel. McGraw Hill, Latest Edition.

**MODE OF TEACHING:** Lectures/Demonstrations

**GRADING:** As per NUST statutes.

**Course Outline:**

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

**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 venturimeter 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 momentum theory.
10. To study the fluid friction head losses which occur when an incompressible fluid 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 multiple pumps connected in series and in parallel, with varying flow rates and pump speed.

# **SEMESTER-V**

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **MATH-361 PROBABILITY & STATISTICS**

**Credit Hours:** 3-0

**Contact Hours:** (3,0)

**Text Book:** Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition, Wiley Publishers, 2011

**Reference Book:** Probability and Statistics by Murray R. Spiegel.

**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.
8. Marginal distribution, Distributions of Several Random Variables
9. 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**

<b><u>SUBJECT</u></b>	<b><u>ME-310 MECHANICS OF MATERIALS-II</u></b>
<b><u>CREDIT HOURS</u></b>	3-1
<b><u>CONTACT HOURS</u></b>	3-3 PER WEEK
<b><u>COURSE OBJECTIVES</u></b>	<ul style="list-style-type: none"><li>a. To understand shear force and bending moment in beams.</li><li>b. To develop the concept of stress and strain.</li><li>c. To analyze determinate and indeterminate beams.</li><li>d. To understand concepts of stress concentration, fatigue, creep, fracture etc.</li></ul>
<b><u>TEXT BOOK</u></b>	Mechanics of Materials, Russell C. Hibbeler, 8 <sup>th</sup> Edition, Prentice Hall, 2010
<b><u>REFERENCE BOOK</u></b>	Mechanics of Materials by Beer and Johnston, McGraw Hill, 1999
<b><u>PREREQUISITE</u></b>	Mechanics of Materials I
<b><u>MODE OF TEACHING</u></b>	Lectures
<b><u>GRADING</u></b>	As per NUST statutes

### **Course Outline:**

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

No.	Topics
1	<b>Transformation of Stresses and Strains:</b>
2	<b>Principal Stresses and Strains, Mohr's Circles, Stresses on Oblique Planes – Principal Stresses:</b>
3	<b>Theories of Failure for Solids:</b>
9.	<b>Unsymmetrical Bending:</b>

## **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

# **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-221 MANUFACTURING PROCESSES**

**CREDIT HOURS:** 3-0

**CONTACT HOURS:** 3 Hours per week

**TEXT BOOK:** 1) Fundamental of Modern Manufacturing (Material, Processes & System) by Mikell P Groover Prentice Hall (1996)  
Begeman, 8th Edition, Wiley; 1987  
2) Manufacturing Processes for Engineering Materials, Serope Kalpakjian & Steven R. Schmid, 4th Edition, Prentice Hall, 2002

**REFERENCE BOOK:** 1) Manufacturing Technology by Stanley A. Komacek, Ann E. Lawson & Andrew C. Horton.  
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)



# **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:****ME-312 MEASUREMENT & INSTRUMENTATION****CREDIT HOURS:**

2-0

**CONTACT HOURS:**

2 Hours per Week

**TEXT BOOK:**

Electronic Instrumentation and Measurements      David A. Bell

Theory and Design for Mechanical Measurements, Richard S. Figliola and Donald E. Beasley, 4th Edition, John Wiley, 2006.

**REFERENCE BOOKS:**

Measurement Systems: Application and Design, Ernest O. Doebelin, 4th Edition, McGraw-Hill, 1990.

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:

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:**                **ME-323 MANUFACTURING PROCESSES & INSTRUMENTATION LAB**

**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

# **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-325 ENGINEERING ECONOMICS**

**Credit Hours:** 2-0

**Contact Hours:** (2,0)

**Text Book:** Engineering Economy, DeGarmo, E. P., W. G. Sullivan, J. A. Bontadelli, and E. M. Wicks, 10th Edition, Prentice Hall, 1997

**References:** Samuels on, "Economics"

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

**GRADING:** As per NUST statutes.

## **Course Outline:**

1. Fundamental Concepts in Economics, Definitions.
2. Type of Costs - Time value of money, Taxes, Cash Flow Diagrams.  
Economics equivalence, The cost of capital, stock and bond valuation.  
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

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**Subject:** **EE-212 BASIC ELECTRONICS**

**Credit Hours:** 2-1

**Contact Hours:** (2,3)

**Text Book:**

- i) Electronic Devices 6<sup>th</sup> Edition, By Floyd, Prentice Hall
- ii) Electronic Principles By Malvino, A.Paul, McGraw Hill
- iii) Digital Computer Electronics 2<sup>nd</sup> Edition , By Malvino, McGraw Hill.

**GRADING:** As per NUST statutes.

### **Details of Syllabus**

1	Semiconductor Theory & Electronics Fundamentals
2	Diodes and its applications
3	Special Purpose Diodes
4	Bipolar Junction Transistors, Transistor Modeling, 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-VI**

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

<b>Subject:</b>	<b><u>MATH-351 NUMERICAL METHODS</u></b>
<b>Credit Hours:</b>	03
<b>Contact Hours:</b>	(3,0)
<b>Text Book:</b>	Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition, Wiley Publishers, 2011
<b>References:</b>	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.
2. Iterative Methods for the Solutions of Non-Linear Equations Fixed point Method, Newton-Raphson Method, Secant Method, Bisection Method, Regula-Falsi Method; Convergence.
3. Interpolation: Lagrange Interpolation, Newton's Divided Difference, Forward Difference and Backward Difference Interpolations.
4. Numerical Differentiation
5. Cubic Spline Interpolation
6. Numerical Integration: Rectangular, Trapezoidal and Simpson's Rules. Determination of Required Accuracy.
7. Numerical Methods in Linear Algebra. Systems of linear Equations, Gauss Elimination Method
8. LU Factorization: Doolittle's, Crout's and Cholesky's Methods
9. Iterative Methods for Systems of Equations: Gauss-Seidel Method, Jacobi's Method
10. Method of least squares.
11. Evaluation of Eigenvalues by Iteration: Power Method, Eigenvectors.
12. Solution of 1<sup>st</sup> and 2<sup>nd</sup> Order Ordinary Differential Equations Euler Method, Heun's Method, Runge-Kutta Method, Runge-Kutta-Nystrom Method
13. Solution of Elliptic Partial Differential Equations, Laplace and Poisson Equations, Dirichlet Problem
14. Neumann and Mixed Problem, Irregular Boundary
15. Solution of Parabolic PDEs: Crank-Nicolson Method
16. Solution of Hyperbolic PDEs



# **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-420 PROJECT MANAGEMENT**

**CREDIT HOURS:** 2-0

**Contact Hours:** (2,0)

**TEXT BOOK:**

1. Production and Operations Management, Alan Muhlemann, John Oakland and Keith Lockyer, 5th Edition, Nichols Publishers, 1988
2. Production and Operations Management, Norman Gaither and Greg Frazier, 8th Edition, South-Western Publishers, 1998.
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**

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-311 MACHINE DESIGN**

**CREDIT HOURS:** 3-0

**CONTACT HOURS:** 3 Hours per Week

**TEXT BOOK:** Mechanical Engineering Design, Joseph E. Shigley & Charles R. Mischke,  
McGraw-Hill, Latest Edition

**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**

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

<b><u>SUBJECT:</u></b>	<b><u>ME-315 MECHANICS OF MACHINES</u></b>
<b><u>CREDIT HOURS:</u></b>	2-1
<b><u>CONTACT HOURS:</u></b>	2-3 per week
<b><u>TEXT BOOK:</u></b>	Design of Machinery: An introduction to Synthesis and Analysis of Mechanisms and Machines, R. Norton, 3 <sup>rd</sup> Edition, McGraw-Hill, 2003
<b><u>REFERENCE BOOK:</u></b>	J.E. Shigley and Uicker, Theory of Machines and Mechanisms, McGraw-Hill New York, 1992.
<b><u>GRADING:</u></b>	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

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

<b><u>SUBJECT:</u></b>	<b><u>ME-330 HEAT AND MASS TRANSFER</u></b>
<b><u>CREDIT HOURS:</u></b>	3-0
<b><u>CONTACT HOURS:</u></b>	3 Hours per Week
<b><u>TEXT BOOK:</u></b>	Heat Transfer A Practical Approach, Younus A. Cengel, McGraw Hill. Latest Edition
<b><u>REFERENCE BOOK:</u></b>	1. Fundamentals of Heat Transfer, F.P Incropera and D.P. Dewitt, 6 <sup>th</sup> Edition, J.Wiley and sons, 2006 2. J. P. Holman, Heat Transfer, 8 <sup>th</sup> Edition, McGraw Hill Inc, 1997
<b><u>PREREQUISITE:</u></b>	Thermodynamics I.
<b><u>GRADING:</u></b>	As per NUST statutes.

**Course Outline:**

1.	INTRODUCTION
2.	CONDUCTION HEAT TRANSFER
3.	FREE AND FORCED CONVECTION
4	FREE CONVECTION
4	RADIATION:
5	HEAT TRANSFER WITH CHANGE OF PHASE: .
6	HEAT EXCHANGERS
7	MASS TRANSFER:

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-331 REFRIGERATION AND AIR CONDITIONING**  
**CREDIT HOURS:** 3-0  
**CONTACT HOURS:** 3 per week  
**TEXTBOOK:** “Refrigeration & Air-conditioning”, W. F. Stoecker & J. W. Jones, McGraw-Hill, Latest Edition.

**REFERENCE BOOKS:**

1. “Thermodynamics: An Engineering Approach”, Yunus A. Cengel and Michael A. Boles, McGraw Hill Inc. Latest Edition.
2. “Trane Air Conditioning Manual” by Trane Air Conditioning, 1999-2001.
3. 2005 ASHRAE Handbook – FUNDAMENTALS.
4. 1998 ASHRAE Handbook – REFRIGERATION.

**PREREQUISITE:** Thermodynamics-II

**MODE OF TEACHING:** Lectures/Lab

**GRADING:** As per NUST statutes.

**Course Outline:**

1.	INTRODUCTION to Air conditioning and Refrigeration
2.	REFRIGERANTS AND COMPONENTS
3.	REFRIGERATION CYCLES
4.	PSYCHROMETRY AIR-CONDITIONING
5.	HEATING AND COOLING LOAD CALCULATION - HUMAN COMFORT
6.	AIR TRANSMISSION , DISTRIBUTION AND SYSTEM DESIGN
7.	WATER TRANSMISSION, DISTRIBUTION AND SYSTEM DESIGN

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**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.
7. Demonstration of the Inverse Square Law for heat and light.
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
14. Determination of the inlet power, generated heat and performance coefficient. Water as heat source.
15. Determination of the Inlet Power, Produced Heat and performance Coefficient. Air as Heat Source.
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**

**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-314 CONTROL SYSTEMS**

**CREDIT HOURS:** 3-0

**CONTACT HOURS:** 3 per Week

**TEXT BOOK:** Control system engineering. Norman S. Nise. Wiley. Latest Edition.

**REFERENCE BOOK:** Modern Control Engineering, Katsuhiko Ogata, 5<sup>th</sup> Edition, Prentice-Hall, 2009.  
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 statutes.

**COURSE OUTLINE:**

No.	Topics
1	<b>Introduction to Control Systems:</b>
2	<b>Mathematical models of systems:</b>
3	<b>Feedback control system – characteristics and performance, Test input signals:</b>
4	<b>The Root Locus Method:</b>
5	<b>Frequency Response Method:</b>
6	<b>State space method:</b>



**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-421 MECHANICAL VIBRATIONS**

**CREDIT HOURS:** **3-0**

**CONTACT HOURS:** 3 Hours per Week

**TEXT BOOK:** 1. Mechanical Vibrations, Singiresu Rao, 4th Edition, Prentice Hall, 2003

**Reference Book**

1. Theory of Vibrations with Applications, William T Thomson, Prentice Hall, Latest Edition
2. Fundamentals of Vibrations, Leonard Meirovitch, 1<sup>st</sup> Edition, McGraw-Hill, 2001

**GRADING:** As per NUST statutes.

**COURSE OUTLINE:**

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

**SUBJECT:**

**ME-410 VIBRATIONS & CONTROLS LAB**

## **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**

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **ME-448 INTERNAL COMBUSTION ENGINES**

**CREDIT HOURS:** **2-1**

**CONTACT HOURS:** 2-3 Hours per Week

**Text Book(s):** 1. Internal Combustion Engines: Applied Thermosciences, Colin R. Ferguson, Allan T. Kirkpatrick, 2nd Edition, Wiley, 2000.

**Reference Book(s):** 1. Edward F. Obert, Internal Combustion Engines and Air Pollution, Harper & Row New York 1985.

**Grading:** As per NUST statutes.

### **Course Learning Outcomes:**

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

### **Course Outline:**

1. Introduction to IC Engines
2. Air Standard cycles for IC engines
3. Engine design & operating parameters
4. Combustion in Spark Ignition & Compression Ignition Engine
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**

## **NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY**

**SUBJECT:** **MGT-271 ENTREPRENEURSHIP**

**CREDIT HOURS:** 2-0

**CONTACT HOURS:** 2-0 Hours per Week

**TEXT BOOK:**

1. Rober D. Hisrich and Michael P. Peter, Entrepreneurs/lip, 5<sup>th</sup> Edition, McGraw Hill
2. S.S. Khanka, Entrepreneurial Development
3. Irving Burstiner, The small Businesses Handbook
4. Bruce A. Kirchhoff, Entrepreneurship and Dynamic Capitalism
5. Modern Business Management, A System & Environment Approach by McGraw Hill
6. William D. Bygrave, The Portable MBA in Entrepreneurship, CEF, Germany, Development Manual

**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.
- The business plan as selling document, reasons for writing a business plan your company: What's your identity, Field work started, Marketing issues: Who are your buyers?., Product issues: What are you selling?, Production exercise, Sales and Promotion: Financial issues: Targeting and writing the plan: Business Plan compilation exercise.
- Product planning and development process. Creating parallel competition by developing a similar product or service, Product life cycle.