**DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING**

# SYLLABI OF COURSES FOR B.E. (INDUSTRIAL AND MANUFACTURING ENGINEERING) DEGREE PROGRAMME

# FIRST YEAR

**SPRING SEMESTER** **FALL SEMESTER**

| Course Code | Course Title | Credit Hours | | | Course Code | Course Title | Credit Hours | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Th | Pr | Total | | | Th | Pr | Total |
| ME-101 | Engineering Mechanics | 3 | 1 | 4 | IM-101 | Computer Applications in Engineering | 2 | 1 | 3 |
| ME-111 | Engineering Drawing | 2 | 1 | 3 | IM-105 | Thermo fluids | 3 | 1 | 4 |
| ME-104 | Workshop Practice | 0 | 2 | 2 | PH-122 | Applied Physics | 3 | 1 | 4 |
| HS-105/ HS-127 | Pakistan Studies OR Pakistan Studies for Foreigners | 2 | 0 | 2 | HS-111 | Functional English | 2 | 0 | 2 |
| MT-114 | Calculus | 3 | 0 | 3 | EE-122 | Basic Electricity & Electronics | 3 | 0 | 3 |

# SECOND YEAR

**SPRING SEMESTER** **FALL SEMESTER**

| Course Code | Course Title | Credit Hours | | | Course Code | Course Title | Credit Hours | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Th | Pr | Total | | | Th | Pr | Total |
| IM-203 | Manufacturing Processes | 3 | 1 | 4 | IM-211 | Machine Design | 3 | 1 | 4 |
| IM-208 | Materials Engineering | 3 | 1 | 4 | IM-212 | Computer Aided Engineering Design | 2 | 1 | 3 |
| IM-209 | Mechanics of Material | 3 | 1 | 4 | IM-213 | Metrology & Quality Control | 3 | 1 | 4 |
| MT-252 | Introduction to Probability & Statistics | 3 | 1 | 4 | MF-303 | Applied Economics for Engineers | 3 | 0 | 3 |
| HS-205/ HS-209 | Islamic Studies OR Ethical Behaviour | 2 | 0 | 2 | MT-225 | Linear Algebra & Ordinary Differential Equations | 3 | 0 | 3 |

# THIRD YEAR

**SPRING SEMESTER** **FALL SEMESTER**

| Course Code | Course Title | Credit Hours | | | Course Code | Course Title | Credit Hours | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Th | Pr | Total | | | Th | Pr | Total |
| IM-303 | Production Management | 3 | 1 | 4 | IM-307 | Advance Manufacturing Processes | 3 | 1 | 4 |
| IM-310 | Tool Design | 3 | 1 | 4 | IM-308 | Operations Research | 3 | 1 | 4 |
| IM-312 | Applied Thermo Fluid | 3 | 1 | 4 | IM-320 | Modeling & Simulation | 2 | 1 | 3 |
| MT-333 | Advance Calculus & Fourier Analysis | 3 | 0 | 3 | IM-408 | Automation & Robotics | 3 | 1 | 4 |
| HS-304 | Business Communication & Ethics | 3 | 0 | 3 | IM-411 | Methods Engineering | 2 | 1 | 3 |

# FINAL YEAR

**SPRING SEMESTER** **FALL SEMESTER**

| Course Code | Course Title | Credit Hours | | | Course Code | Course Title | Credit Hours | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Th | Pr | Total | | | Th | Pr | Total |
| IM-402 | Computer Aided Manufacturing | 3 | 1 | 4 | IM-413 | Plant Engineering | 3 | 1 | 4 |
| IM-405 | Finite Element Analysis | 3 | 1 | 4 | IM-417 | Health Safety & Environment | 2 | 1 | 3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| IM-## | Elective | 3 | 1 | 4 | HS-403 | Entrepreneurship | 3 | 0 | 3 |
| MG-450 | Principles of Supply Chain Management | 3 | 0 | 3 | MT-441 | Advance Mathematical Techniques | 3 | 0 | 3 |
| IM-409 | Manufacturing Engineering Projects | - | - | - | IM-409 | Manufacturing Engineering Project | 0 | 6 | 6 |
| **Elective Courses** | | | | | | | | | |
| IM-416 | Management Information System | | | | | | | | |
| IM-418 | Condition Monitoring | | | | | | | | |
| IM-419 | Project Management | | | | | | | | |

## ME 101 ENGINEERING MECHANICS

***Static's of Particles:***

Forces in a plane; Newton's First Law, Free body diagram; Forces in space (rectangular components); Equilibrium of a particle in space.

***Kinematics of Particles:***

Rectilinear and curvilinear motion of particles; Components of velocity and acceleration; Motion relative to a frame in translation.

***Kinetics of Particles:***

Newton's Second Law; Dynamic equilibrium; Rectilinear and curvilinear motion; Work and energy; Kinetic energy of particle; Principle of Work and Energy; Conservation of energy; Impulse and momentum; Impulsive forces and conservation of momentum; Impact, direct and oblique; Conservation of angular momentum.

***Rigid Bodies:***

Equivalent systems of forces; Principle of transmissibility; Moment of a force; Couple; Virginians Theorem. Centre of gravity of a three-dimensional body and centroid of a volume. Moments of inertia, radius of gyration, parallel axis theorem.

***Equilibrium of Rigid Bodies:***

Free-body diagram; Equilibrium in two and three dimensions; Reaction of supports and connections; Equilibrium of two-force and three-force bodies.

***Kinematics of Rigid Bodies:***

General Plane motions; Absolute and relative velocity and acceleration.

***Plane Motion of Rigid Bodies:***

Forces and acceleration; Energy and momentum; Conservation of linear and angular momentum.

***Friction:***

Laws of dry friction; Angles of friction; Wedges; Square-threaded screws; Journal and thrust bearings; Belt friction.

***Analysis of Structures:***

Internal forces and Newton's Third Law; Simple and space trusses; Joints and sections; Frames and machines. Forces in cables.

## ME 111 ENGINEERING DRAWING

Drawing equipment and the use of instruments; Basic drafting techniques and standards; Geometrical curves including plane curves; Cycloid, Hypocyloid, and the Involute.

Intersections at various positions of geometrical bodies such as prisms, pyramids, cylinders and cones. Development of surfaces of prisms. Pyramids, cylinders and cones.

Freehand sketching of machine and engine components; Locking arrangements; Foundation bolts; Stuffing box; Shaft couplings; Foot-step bearing; Pulleys; Engine connecting rod.

Concept of working drawing of component parts of machines and engines; Size, description, dimensions, and specifications; Limit dimensioning and geometric tolerancing; limits; Fits and tolerances, conventional symbols.

Sectioning of machine and engine components; Orthographic projections and standard practices.

Isometric views with particular reference to piping and ducting.

## ME 104 WORKSHOP PRACTICE

Use of carpenter's tools; Exercises in preparing simple joints; Bench-fitting practice; Exercise in marking and fittings; Use of measuring instruments.

Smith's forge; Exercise in bending, upsetting and swage.

Familiarizing the students with the following processes:

Soldering and brazing, Welding, Heat treatment, Moulding and casting.

Simple machine shop processes, such as turning, shaping, milling, and sheet metal work.

## HS 105 PAKISTAN STUDIES

***An Outline of Emergence of Pakistan:***
A brief historical survey of Muslim community in the sub-continent. War of Independent 1857 and Aftermatch. Sir Syed Ahmed Khan, Development of Two Nation Theory. Formation of Muslim League. Lucknow Pact. Khilafat & Non-Cooperation Movement. Political Events from 1924 to 1937. Pakistan Resolution - Struggle for Pakistan from 1940 to 1947. Emergence of Pakistan.

***Land of Pakistan:***
Geophysical conditions, Territorial situation and its importance, Natural Resources - Mineral and Water.

***Constitutional Process:***
Early effects to make constitution - Problems and issues. Constitution of 1956 and its abrogation. The constitution of 1962 and its annulment. Constitutional and Political Crisis of 1971; The constitution of 1973. Recent constitutional developments.

***Post Independence Development:***
Education in Pakistan; Planning & Development in the Field of Education. Development of Science and Technology with special reference to Engineering and Architecture.

Brief survey of Pakistan Economy: Industrial and Agricultural Development. Internal and external trade. Economic planning and prospects.

Cultural Development in Pakistan: Definition, Contents and Contributing factors in culture, Development of Art, Philosophy and literature.

***Foreign Policy:***
Relations with neighbors, Super powers and the Muslim World.

## HS 127 PAKISTAN STUDIES FOR FOREIGNERS

***Land of Pakistan:***
Land & People –Strategic importance – Important beautiful sights – Natural resources (some portion of economics of Pakistan)

***A brief Historical Background:***
A brief historical survey of Muslim community in the sub-continent – British rule & its impacts – Indian reaction – Two nation theory Origin and development – Factors leading towards the demand of a separate Muslim state – Creation of Pakistan.

***Government & Political Development in Pakistan:***
Constitution of Pakistan – A brief outline – Governmental structure Federal and Provincial – Local Government Institutions – Political History a brief account.

***Pakistan & the Muslim World:***
Relations with the Muslim countries.

***Language and Culture:***
Origins of Urdu Language - Influence of Arabic & Persian on Urdu Language & Literature - A short history of Urdu literature - Dominant Culture features.

## MT 114 CALCULUS

***Set and Functions:***
Define rational, irrational and real numbers; rounding off a numerical value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, DeMorgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions). Graph of some well-known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

***Propositional Logic:***
Definition of Proposition, Statement and Argument, Logical Operators, Simple and Compound proposition, various types of connectives, Truth table, tautology, Contradiction, Contingency & Logical equivalence.

***Boolean Algebra:***
Definition, Boolean function, duality, some basic theorems & their proofs, two valued Boolean algebra, Truth functions, Canonical sum of product form, Digital logic Gates & Switching circuit designs.

***Complex Number:***

Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions)

***Differential Calculus:***

Differentiation and Successive differentiation and its application; Leibnitz theorem, Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series, Taylor and Maclaurin series, L` Hospitals rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, exact differential and its application in computing errors, extreme values of a function of two variables with and without constraints. Solution of non-linear equation, using Newton Raphson method.

***Integral Calculus:***

Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence, Beta and Gamma functions and their identities, applications of integration. Centre of pressure and depth of centre of pressure.

***Sequence & Series:***

Sequence, infinite series Application of convergence tests such as comparison test, Roots, Ratios, Raabe's test and Gauss test on the Behaviour of series

***Complex Numbers:***

Argand Diagram, De Moivre formula, root of polynomial equations, curves and regions in the complex plane, standard functions and their inverses (exponential, circular and Hybolic functions).

## IM 101 COMPUTER APPLICATIONS IN ENGINEERING

**Computer Programming Basics:**

General terminologies, Computing application software, General and Scientific programming languages, Computer programming methods, Compilation and interpretation.

**Programming Environment:**

Work space, Files and file management, data types, Display options, Accuracy and Precision, Scripts

**Functions and graphs:**

Solving and plotting functions: Trigonometry, Complex numbers, Logarithm, Polynomials, Partial function expansion. Vector array, Matrix array, Matrix array, Developing Algorithms and using built-in functions of scientific software packages for solving mathematical problems in Matrix algebra, Calculus and Computational geometry

## ME 105 THERMOFLUIDS

***Thermodynamic:***

Basic concepts, Different forms of energy conservation, laws of thermodynamics, Entropy, Two phase systems, phase diagrams, Steam Tables

***Thermodynamics Cycles:***

Cycle work, Thermal efficiency and heat rate, Carnot cycle, Stirling cycle, Otto cycle, Diesel cycle.

***Heat Transfer:***

Basic concepts, Fluid pressure, Interconnected vessels, Force calculations (walls, flat and curved surfaces), Stability of a floating body, Inviscid and viscous flow, Continuity, Euler's and Bernoulli's equations, laminar and turbulent flow, Measurements of pressure and flow rate, Dimensional Analysis.

***Heat Transfer:***

Fundamentals od conduction, convection and radiation heat transfer.

## PH 112 APPLIED PHYSICS

***Introduction:***

Scientific notation and significant figures. Types of errors in experimental measurements. Units in different systems. Graphical Techniques (Log, semi-log and other non-linear graphs)

***Vectors:***

Review of vectors, Vector derivatives. Line and surface Integrals. Gradient of a scalar.

***Mechanics:***

The limits of Mechanics. Coordinate systems. Motion under constant acceleration, Newton laws and their applications. Galilean invariance. Uniform circular motion. Frictional forces. Work and Energy. Potential Energy. Energy conservation. Energy and our Environment. Angular momentum.

***Electrostatics and Magnetism:***

Coulombs Law. Electrostatic potential energy of discrete charges. Continuous charge distribution. Gauss's Law. Electric field around conductors. Dielectrics. Dual trace oscilloscope with demonstration.
Magnetic fields. Magnetic force on current. Hall effect. Biot-Savart Law. Ampere's Law. Fields of rings and coils. Magnetic dipole. Diamagnetism, Para magnetism and Ferromagnetism.

***Semiconductor Physics:***

Energy levels in a semiconductor. Hole concept. Intrinsic and Extrinsic regions. Law of Mass Action. *P-N* junction.
Transistor. Simple circuits.

***Waves and Oscillations:***

Free oscillation of systems with one and more degrees of freedom Solution for Modes. Classical wave equation. Transverse modes for continuous string. Standing waves. Dispersion relation for waves. LC network and coupled pendulums. Plasma oscillations.

***Optics and Lasers:***

Harmonic traveling waves in one dimension. Near and far fields. Two-slit interference. Huygens Principle. Single-slit diffraction. Resolving power of optical instruments. Diffraction Grating. Lasers. Population inversion. Resonant cavities. Quantum efficiency. He-Ne, Ruby and $CO_2$ lasers. Doppler effect and sonic boom.

**Modern Physics:**

Inadequacy of classical physics, Planck's explanations of black body radiation Photoelectric effect, Compton effect. Bohr theory of Hydrogen atom, Atomic spectra, Reduce mass, De-Broglie hypothesis Braggs Law, Electron microscope, Uncertainty relations Modern atomic model, Zeeman effect, Atomic nucleus, Mass-energy relation, Binding energy, Nuclear forces and fundamental forces, Exponential decay and half-life. Radioactive equilibrium in a chain, Secular equilibrium, Nuclear stability, Radiation detection instruments, Alpha decay, Beta decay, Gamma decay attenuation Nuclear radiation hazards and safety, Medical uses of Nuclear Radiation. Fission, Energy release. Nuclear Reactors. Breeder Reactor. Nuclear Fusion.

# EE 122 Basic of Electricity and electronics

***Fundamentals of Electric Circuits:***

Charge, Current Voltage, and Power, Voltage and Current Sources, Ohm's Law;

***Voltage and Current Laws:***

Nodes, Paths, Loops and Branches, Kirchhoff's Current Law. Kirchhoff's Voltage Law, The single loop Circuits, The single Node-pair Circuits, Series and Parallel connected independent sources, Resistors in Series and Parallel, Voltage and Current Division.

***Circuit Analysis Techniques:***

Multi-Nodal Analysis, The super Nopdal, Mesh Analysis, the Super Mesh, Linearity and Superposition, Source Transformation, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion. Capacitor, Inductor, Inductance and Capacitance Combination, The Source-Free RL Circuit, Properties of Exponential Response, the Source- Free RC Circuit.

***Introduction Machines:***

Induction Motors, Construction, Types, Rotating file theory, Principle of working, slip and its effect on motor current quantities, overexcited and under-excited motor, power factor and power factor control, starting of synchronous motor, parallel operation of alternators and sharing of load, working of alternator on infinite bus bars.

***Introduction of Transformer:***

Construction , Principle of working, emf equation, Transformation rations, No load working and vector diagram, magnetizing current, Vector diagram on load.

***One line Diagram:***

Symbols of different components, understanding of one line diagram.

***Basic Electronics:***

P-N junction, diode and applications Transistor construction, operation and applications Fundamental concepts of Digital Electronics.

## PH 122 APPLIED PHYSICS

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Scientific notation and significance figures. Types of errors in experimental measurements. Units in different systems. Graphic techniques (Log, semi,-log and other non linear graphs)

***Vectors:***

Review of vectors, vector derivatives. Line and surface Integrals. Gradient of a scalar

***Mechanics:***

The limits of Mechanics. Coordinate systems. Motion under constant acceleration, Newton Laws and their applications. Galilean invariance. Uniform circular motion. Frictional forces. Work and energy. Potential energy. Energy conservation. Energy and our environment. Angular momentum

***Electrostatics And Magnetism:***

Coulombs law. Electrostatic potential energy of discrete charges. Continuous charge distribution. Gauss's law. Electric field around conductors. Dielectrics. Dual trace oscilloscope with demonstration Magnetic field. Magnetic force on current. Hall effect. Biot-savart Law. Ampere's Law. Fields of rings and coils. Magnetic Dipole.
Diamagnetism, Paramagnetism, and Ferromagnetism Semiconductor Physics:
Energy levels in a semiconductor. Hole concept. Intrinsic and Extrinsic regions. Law of Mass Action. P-N junction.Transistor. Simple circuits

***Waves and Oscillations:***

Free oscillation of systems with one or more degrees of freedom Solution for Modes. Classical Waves equation. Transverse modes for continuous string. Standing waves. Dispersion relation for waves. LC network and coupled pendulums. Plasma oscillations

***Optics and Lasers:***

Harmonic traveling waves in one dimension. Near and far fields Two-slit interference. Huygens Principle. Single slit diffraction. Resolving power of optical instruments. Diffraction Grating Lasers. Population inversion. Resonant cavities. Quantum efficiency. He-Ne, Ruby and CO2 lasers. Doppler effect and sonic boom.

***Modern Physics:***

Inadequacy of classical physics, Planck's explanations of black body radiation Photoelectric effect, Compton effect. Bohr theory of Hydrogen atom, Atomic spectra, Reduce mass, De-Broglie hypothesis Braggs Law, Electron microscope, Uncertainty relations Modern atomic model, Zeeman effect, Atomic nucleus, Mass-energy relation, Binding energy, Nuclear forces and fundamental forces, Exponential decay and half-life. Radioactive equilibrium in a chain, Secular equilibrium, Nuclear stability, Radiation detection instruments, Alpha decay, Beta decay, Gamma decay attenuation Neclear radiation hazards and safety, Medical uses of Nuclear Radiation. Fission, Energy release. Nuclear Reactors. Breeder Reactor, Nuclear Fusion

## HS 111 FUNCTIONAL ENGLISH

***Introduction to Functional English***

Significance of the course and students diagnostic test.

***Vocabulary Development***

Practice in vocabulary development, Inferring meaning from context, word formation, idiomatic expression

***Listening Skill***

Types of listening: active, critical, selective, etc. Problems in listening and coping strategies, Listening skills and sub skills.

***Reading Skill and Strategies***

Strategies used in reading texts: skimming and scanning, Summarizing, Inference.

***Note Taking***

Techniques for taking notes from lectures, from books (Lecture), Note taking in different forms paragraphs, points, figures, processes, tables, graphs etc. (Worksheets).

***Speaking Skill***

Importance of speaking and techniques to effective communication. Types of speaking: persuasive, informative, etc.

***Writing Skill***

Process of Writing with practice in pre writing strategies, in revising, and in, editing for grammar, Writing well- structured and effective essays, and letters using proper writing mechanics.



## IM 208 MATERIALS ENGINEERING

***Introduction to Materials Engineering:***

Types of materials, sources of materials, material science and engineering crystalline & amorphous materials, application of materials.

***Metallic Materials:***

Pure metals and alloys, nature and properties of metals and alloys, major properties of metallic materials (chemical, physical, mechanical), single crystal and poly-crystalline metals, crystal defects and the mechanisms of deformation and fracture, plastic flow in poly-crystalline materials, structure- property, relationships, macro & micro examinations, structural aspects of solidification & solid phase transformations in binary systems, ferrous and non-ferrous metals, various heat treatments, TTT- diagram.

***Ceramics, Glasses, Rubbers & Refractory Materials:***

Compositions, properties, structures of various non-metallic materials, application of ceramics, glasses, rubber & refractory materials, methods of manufacture.

***Polymers:***

Polymerization, Structural feature of Polymers, Thermoplastic Polymers, Thermo-setting Polymers, Additives, major mechanical properties.

***Composites:***

Introduction to composite materials; types of composite materials, method of fabrication of composite materials, property averaging, major mechanical properties.

***Environmental Degradation:***

Metal degradation by atmospheric, aqueous & galvanic corrosion; stress corrosion cracking methods of corrosion prevention, behaviors of metal at elevated temperature – pyrometers oxidation, scaling and creep. Chemical degradation of ceramics & polymers, radiation damage, surface improvement against degradation.

## IM 209 MECHANICS OF MATERIALS

***Stress-Strain Relations:***

Stress, Deformation, strain, elastic stress strain behavior of materials, Poisson's ratio,General stress method, Thermal stress and strain

***Statically indeterminate System:***

Volume changes, Constrained materials, , superposition method, Virtual work).

***Bending Stresses:***

Simple bending theory, shear stresses in bending, bending slope and deflection, asymmetrical bending, bending of initially curved bars

***Theory of Torsion:***

Torsion of thin walled cylinder, Torsion of a solid circular shaft, Hollow shaft, Torsion of rectangular and non circular sections, Helical Springs.

***Theory of Columns and Pressure vessels:***

Long columns, struts, columns with initial curvature, Stresses and strains In pressure vessels.

## MT 252 INTRODUCTION TO PROBABILITY & STATISTICS

***Statistics:***

Introduction, Types of data & variables, Presentation to data, Tabulation, Frequency distribution, Graphical representation, Simple & multiple bar diagrams, Pie-diagram, Histogram, Frequency polygon, Frequency curves & their types, Measures of central tendency and dispersion: Statistical averages, Median, Mode, Percentiles, Quartiles, Range, moments, Skewness & kurtosis, Quartile deviation, Mean deviation, Standard deviation, Variance & its coefficient, Practical significance in related problems.

***Probability:***

Basic concepts, permutation & combination, definitions of probability, laws of probability, conditional probability, Bayes' rule, related problems in practical significance.

***Random Variable:***

Introduction, Discrete & continuous random variables, Random sequences and transformations, Probability mass function, Probability density function, Distribution function, Mathematical expectations, Moment generating function (M.G.F.).

***Probability Distributions:***

Introduction, Discrete probability distributions: Binomial, Poisson, Hyper geometric & Negative binomial distributions, Continuous probability distribution: Uniform, Exponential, Gamma & Normal distributions & their practical significance.

## HS 205 ISLAMIC STUDIES

Themetic Study of Holy Quran.
1. ***Basic Islamic Believes***
Topics
i) *Tauheed:*
Al-Ambiya-22, Al-Baqarah-163-164
ii) *Prophethood:*
Al-Imran-79, Al-Huda-7 Al-Maidah-3
iii) *Here-After:*
Al-Hajj-5, Al-Baqarah-48
*Two Hadith

**2. *Basic Islamic Practices:***
Al-Mu'minun-l-ll

**3. *Amre-Bil-Ma'Roof Wa-Nahi Anil Munkar***
The Concept of Good & Evil.
i) Importance & necessity of Da'Wat-e-Deen Al-Imran-llO.
ii) Method of Da'Wat-e-Deen. An-Nehl-125, Al-Imran-l04

*Two Hadith

**4. *Unity of the Ummah:***
Al-Imran-l03, Al-Hujurat-l0, Al-Imran-64, AI-An'am-l08
*Two Hadith

**5. *Kasb-e-Halal.***
Taha-8l, Al-A'raf-32-33, Al-Baqarah-188
*Two Hadith.

**6. *Huquq-ul-Ibad:***
i) *Protcetion of Life*
AI-Maidah-32

ii) *Right to Property*
An-Nisa-29

iii) *Right of Respect & Dignity*
AI-Hujurat-11-12

iv) *Freedom of Expression*
AI-Baqarah-256

v) *Right of Equality*
AI-Hujurat-13

vi) *Economic Security*
AI-Ma'arij-24-25

vii) *Exployment Opportunity on Merit*
An-Nisa-58

viii) *Excession Right to Justics*
An-Nisa-135

**7 .*Women Rights:***
An-Nehl-97, AI-Ahzab-35, An-Nisa-O7

**8. *Relations With Non-Muslims:***
AI-Mumtahanah-8-9, AI-Anfal-61.
Last sermon of Hajj at Arafat, Translation & the important points of the sermon.

***Serat Life of the Holv Prophet:***
Birth, Life at Makkah.Declaration of Prophethood, preaching & its difficulties migration to Madina. Brotherhood (Mawakhat) & Madina charter. The Holy War of the prophet (Ghazwat-e-Nabawi) Hujjat-ul- Wida.

***Islamic Civilization:***
Impacts of Islamic civilization on the sub-continent. The civilization of sub- continent before Islam. The Political, Social & Moral impacts of Islamic Civilization on sub-continent.
Academic, Intellectual, Social & Cultural Impacts of Islam on the World.

## HS 209 ETHICAL BEHAVIOUR

**1. Introduction to Ethics:**

i) Definition of Ethics
ii) Definition between normative and positive science
iii) Problem of freewill
iv) Methods of Ethics
v) Uses of Ethics

**2. Ethical Theories:**

i) History of Ethics: Greek Ethics, Medieval, Modern Ethics
ii) Basic Concepts of right & wrong: good & evil
iii) Utilitarianism, hedonism, self-realization: egoism, intuitionism, rationalism
iv) Kant's moral philosophy

**3. Ethics & Religion:**

i) The relation of Ethics to religion
ii) Basic ethical principles of major religions: Hinduism, Judaism, Buddhism, Zoroastrianism, Christianity, Islam

**4. Ethics, Society and Moral Theory:**

- Society as the background of moral life
- Ethical foundation of rights of moral life
- Universalism and Altruism
- Applied Ethics
- Theories of punishment

## IM 211 MACHINE DESIGN

***Principle of Design:***

General procedure for design, Mechanical properties of materials,
Stresses in machine elements, Stress concentration, Composite sections, Theories of failure including fatigue failure.

***Design of Machine elements:***

Shafts, Shaft materials, Shaft operating under combined loading, Critical speed, Introduction to flexible shafting, connecting rods, Crankshafts, Bearings, Bearing materials, Design of journal and roller bearing, Theory, and method of lubrication, Gyroscopes (principle, operation, and applications), Balancing of reciprocating and Rotating masses.

***Design of Drive Units and Assemblies:***

Gear (terminologies, classification and design), Design of gear boxes/trains, Belt and chain drives, Design of chain including drag chain conveyors and belt conveyors, Brakes, Clutches; Friction and mechanical type of clutches, Linkages, Cams, Joint (knuckle, Cotter and universal), Couplings (universal, flanged and flexible). Spring, Design of leaf springs.

## IM 212 COMPUTER AIDED ENGINEERING DESIGN

***Introduction to CAD:***

CAD applications in Engineering, Mechanical product design, CAD, CAM and CAE integration, Components of CAD.

***Graphic Programming:***

Concepts of Graphics Programming, Coordinate transformations, Projections.

***Geometric Modeling Systems:***

Modeling Methods, set operations Constructed solid geometry, Boundary representation.

***Curves and Surfaces:***

Representation of Curves & Surface Types of representations, Analytic, manipulation of curves and surfaces

***Data Exchanges:***

CAD/CAM Data Exchange Data types and exchange methods, Neutral data exchange format: IGES, STEP

***Applications of CAD:***

Reverse Engineering & Rapid Prototyping/Manufacturing3D scanning and its types, Surface fitting on cloud data rapid prototyping and manufacturing

## IM 213 METROLOGY AND QUALITY CONTROL

***Metrology:***

Introduction, History and Philosophy of Metrology, Metrology and the need for Reliable Measurement. Metrology Classifications

***Standardization:***

Standardization Organizations and their Standards related to metrology, International Classification for metrology Standards, Interchangeability.
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***Measurements:***

Common Gauges & Measurement Instruments, Special Gauges and application, Gauge Selection and handling and use, Surface Plate Tools and Techniques, Specialized Inspection Equipment, Calibration. Surface Texture.

***Measurement System Analysis:***

Process Variability, Variability in Measurement Process, Evaluating Measurement System Performance. Inspection Planning & processes, defining SPC/SQC and its Tools/ Techniques

***Quality control***

Introduction, Statistical Methods in Metrology, Defining Quality & its Philosophies, defining SPC/SQC and its Tools/Techniques.

***Quality Control Tools:***

Flow Chart, Check Sheet, Histogram, Pareto Chart, Scatter Diagram, Cause and Effect Diagram, Variable & Attribute Control Charts.

***Acceptance Sampling:***

OC Curve, Consumer & Producer Risks, AQL & LTPD, Sampling Errors, Acceptance Sampling for Continuous Production, Acceptance by Variables, Single, Double, & Sequential Sampling.

***Process Capability:***

Cp/Cpk

***Reliability:***

Introduction, Life History Curve, Taguchi Loss Function.

## MF 303 Applied Economics for Engineers

***Introduction***
Engineering economy defined; Measures of financial effectiveness; Non-monetary factors and multiple objectives; principles of engineering economy.

***The Economic Environment***
Consumer and producer goods; Measures of economic worth; Price, Supply, & Demand relationship; Production; Factors of production; Laws of return.

***Cost Concepts & Analysis***
Sunk & opportunity costs; Fixed, variable, and incremental costs; Recurring & nonrecurring costs; Direct, indirect, and overhead costs; Standard costs; Breakeven analysis; Unit cost of production; Cost-benefit analysis; Feasibility studies; Value analysis in designing & purchasing.

***Time Value of Money***
Simple interest, Compound Interest, Cash flow diagrams, Interest formulas, Nominal versus effective interest rates, continuous compounding.

***Depreciation and Depletion***

Purpose of depreciation, types of depreciation, economic life, what can be depreciated?

***Comparing Alternatives***

Present economy, Selection among machines, materials, processes, and designs, Payback period method, Present worth method, Uniform annual cost method, Rate of return method, Alternatives having identical live, Alternatives having different lives.

***Production Concepts & Mathematical Models***

Manufacturing lead time; Production rate; Capacity; Utilization; Availability; Work in process; WIP and TIP ratios.

***Linear Programming***

Mathematical statement of linear programming problems; Graphic solution; Simplex method; Duality problems.

***Capital Financing and Budgeting***

Types of ownership; types of stock; Partnership & joint stock companies; Banking & specialized credit institutions.

***Industrial Relations***

Labour problems; Labour organizations; Prevention & settlement of disputes.

## MT 225 LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS

***Linear Algebra:***

Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non- singular, symmetric, non- symmetric, upper, lower, diagonal tri-diagonal matrix), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, transitions matrix, basic concept of tensors, eigen value and eigen vectors of a matrix, Diagonolization, Cayley-Hamiton theorem. Applications of linear algebra in Engineering.

***Euclidean Spaces and Transformation:***

Geometric representation of vector, norm of vector, Euclidean inner product, projections and orthogonal projections, Euclidean n spaces n properties Cauchy-Schwarz inequality, Euclidean transformations, apply geometric transformations to plane figure, composition of transformations.

***1st Order Differential Equations:***

Basic concept; Formation of differential equations and solution of differential equations by direct integration and by separating the variables; Homogeneous equations and equations reducible to homogeneous from; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations and orthogonal trajectories; Application in relevant Engineering.

***2nd and Higher Orders Equations:***

Special types of II$^{nd}$ order differential equations with constant coefficients and their solutions; The operator D; Inverse operator 1/D; Solution of differential by operator D methods; Special cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering.

***Lap lace Integral & Transformation:***

Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the nth order derivative, initial and final value theorem Laplace transform of integrals, Laplace transform of functions $t^n$ F(t) and F(t)/ t, Laplace transform of periodic function, evaluation of integrals, definition of inverse Laplace transform and inverse transforms, convolution theorem, solutions of ordinary differential using Laplace transform.

## IM 303 PRODUCTION MANAGEMENT

***Production Management & Systems:***

Introduction to production Management; System concept; Functions of management; Managerial decision making; Models as decision aids.

***Plant Location & Plant Layout:***

Selection of region; Selection of community; Site selection; Location factor dependence; Sources of assistance; Plant location trends; Quantitative analysis; Plant layout; Product & process layout analysis and comparison; Material handling considerations in layout.

***Production Planning & Control:***

Formalized production planning; Production planning methods; Master scheduling; MRP; MRP inputs, MRP outputs; Product structures; Types of MRP; Capacity planning and control; Production control systems; Job shop scheduling; Production control charts; Scheduling techniques; Purchasing and procurement.

***Planning & control Techniques:***

Inventory control; types of inventory; Inventory costs; Independent versus dependent demand; EOQ/EPQ models; Types of control systems; Selective inventory control; Inventory system development; Project planning; CPM/PERT; Network development; Determination of activity times; Establishment of critical path; Probabilistic statements.

***Cost Estimating:***

Element of cost; Material cost, direct and indirect labour cost and Over head cost. Cost structure; Prime cost, Factory cost, Manufacturing cost, Total cost, Selling price; Estimation of cost elements; Methods of estimation; Economics of tooling.

***Maintenance:***

Types of maintenance; Breakdown maintenance; Preventive maintenance; Individual versus group replacement; Internal versus external maintenance.

## IM 310 TOOL DESIGN

***Jigs and Fixtures:***

Basic Design principles and Classification. Materials for jig and fixture development. Lathe, Milling and Broaching fixtures. Detailed discussion of jigs for drilling and drilling related operations. Consideration for mounting jigs and fixtures on machine tools. *Inspection Jigs and*

*Fixtures.* Analysis of operation with design examples.

***Locating and Clamping Methods:***

Principles of Location. Pins, plugs, dowels and nests. Conical Locating, adjustable locators. Clamping principles, design of various clamps with typical applications. Pneumatic and Hydraulic clamping.

***Design of Cutting Tools:***

Design of tools for cutting operations. Single point tools for lathe and boring operations. Multiple point tools for milling and drilling operations.

**Design of Dies and Moulds:**

Terminology of Press-Working operations. Mechanical, Hydraulic and Pneumatic presses. Materials for press tools. Design of Piercing, Blanking and Shearing dies. Design of Bending, Forming and Drawing dies. ***Design of Moulds for plastic and Rubber Parts***. Pressure, Die Casting, Injection and Blow moulding.

## IM 312 APPLIED THERMOFLUIDS

***Flow through pipes:***

Revision of continuity momentum and steady flow energy equation, fraction in pipes and fittings, evaluation of friction losses.

***Selection of pumps:***

The operation of positive displacement pumps, centrifugal pump, including the condition and delivery, Net positive suction Head (NPSH), pump characteristics, Power requirement and pump selection.

***Control valves:***

Most common valve types, design specification, valve characteristics.

***Actuator:***

Electric motors (DC, stepper, brushless and AC) servo motors, piezoelectric actuators, hydraulic and pneumatic actuation systems.

***Refrigeration cycles:***

Reserved Carnot cycle, vapor compression cycle, vapor absorption cycle, multi-pressure systems.

***Application of Refrigeration:***

Domestic refrigerator, water cooler, cold storage, ice making plant, dairy industries, heat pump, use of commercially available software.

***Heat Exchanger:***

Introduction to Heat exchanger, Classification and preliminary design of heat exchangers, applications

## MT 333 ADVANCED CALCULUS & FOURIER ANALYSIS

***Partial Differential Equation:***

Basic concepts and formation of partial differential equations; Linear homogeneous partial differential equations and relations to ordinary differential equations; Solution of first order linear and special types of second and higher order differential equations; D' Alembert's solution of the wave equation and two dimensional wave equations; Lagrange's solution; Various standard forms.

***Fourier series:***

Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients; Expansion of function with arbitrary periods. Odd and even functions and their Fourier series; Half range expansions of Fourier series, " DFT and FFT, Fourier Spectrum".

***Advance calculus:***

Define a stationary point of a function of several variables, define local maximum, and saddle point for a function of two variables the stationary points of a several variables, obtain higher partial derivatives of simple functions of two or more variables, iterated integrals, double and triple integrations with applications (area, centoroid, moment of inertia, surface area, and volume, use multiple integrals in solutions of engineering problems.

***Vector Calculus:***

Vector differential operator, directional derivative, gradient, divergence, curl of a vector field, and laplacian operators with applications. (Solenoid, conservative, etc). Vector Integrations; Evaluate line integrals along simple paths, apply line integrals to calculate work done, apply Green's theorem in the plane to simple examples, evaluate surface integrals over simple surface, use the jacobian to transform a problem a new co-ordinate system, apply Gauss' divergence theorem to simple problems, apply Stokes' theorem to simple examples.

## HS 304 BUSINESS COMMUNICATION & ETHICS

***Business English:***

Writing formal and business letters and memos: Drafting notices and minutes; Theoretical knowledge and comprehension of contracts and agreements; Preparing proposals and conducting and writing research project reports. Participating in seminars and interviews, and writing and presenting conference papers; Solving IELTS type papers.

***Engineering Ethics:***

Definition of code of ethics: Review of code of ethics of national and international engineering bodies. Relationship between ethics and human rights and their importance in human settlements and societies.

## IM 307 ADVANCE MANUFACTURING PROCESSES

***Mechanics of Orthogonal Metal Cutting:***

Chip formation; Thin-zone models for analysis; Shear angle relationships; Role of friction in metal cutting; Prediction of forces; Velocity relationships; Force and stress relationships.

***Tool Life & Tool Wear:***

Forms of wear in metal cutting, Tool life criteria, Variables affecting tool life, Taylor's tool life equation, Generalized tool life equation, Methods of tool life testing data. Economics of Metal Cutting: Application of minimum cost per piece, maximum production rate, and maximum profit rate criteria in turning operations.

***Metal Forming:***

Stress: stress tensor, equilibrium equations, stress transformation equations, plane stress, Mohr's circle for stress transformation. Strain: plane strain, strain tensor, strain transformation equations, isotropic elasticity, strain energy. Bulk forming, sheet forming, Yield criteria, Plastic work, Plastic instability, Effective stress, Effective strain, Flow rules for plastic stress-strain relations.

***Work Hardening:***

Tensile test, Mechanical properties, Nominal & true stress-strain curves, Work hardening expression, Behavior after necking, Direct compression, Bulge test, Plane-strain compression test.

***Bulk Forming Analysis:***

Ideal work method, efficiency factors, extrusion and rod drawing, force balance or slab analysis, deformation zone geometry, sheet drawing, flat rolling, direct compression in plane strain, sheet bending, formability.

***Hot & Cold Working of Metals:***

Advantages and limitations of Hot working and Cold working processes; Methods of Forging; Hammer forging; Die forging; Drop, Press and Upset forging; Construction of drop forging hammers; Forging defects and their causes.

## IM 308 OPERATIONS RESEARCH

**Linear Programming:**

*Historical development of Operations Research, Formulation of Model, Linear programming: Graphical Analysis and Solution, Simplex Method of Solution, Equality constraints, Inequality constraints, Big M method, Duality theory, Primal and Dual problems, & Sensitivity Analysis.*

***Special Types of LP Problems:***

The transportation problem, North-west corner rule, Vogel's approximation method, Russell's method, Transshipment problem, Assignment problem.

***Queuing Theory:***

Basic Queuing process, Assumptions for analysis, Queuing discipline and characteristics, Service mechanism, The birth and death process, Steady-state measures of performance, Single-server models, Multiple-server models, Machine servicing model.

***Dynamic programming:***

Recursive nature of computations in DP, Forward and backward recursion, Selected DP applications.

***Simulation:***

Introduction to simulation and its application in manufacturing.

## *IM 320 MODELING & SIMULATION

***Introduction:***

Modelling & Simulation – Need and Significance of Simulation; Computer Simulation; Randomness in Simulation; Types of Simulation; Simulation Process.

***Spreadsheet Simulation:***

Simulation in a Spreadsheet Environment; Useful Spreadsheet Functions; Numerical Examples of Spreadsheet Simulation.

***Simulation Using Software:***

The Software Environment, Simple Monte Carlo Simulation.

***Modelling Simple Discrete Event Dynamic System (DEDS):***

Drive-Through Pharmacy; Implementation of Model in Software Environment; Introduction to Arrival Process; Resources; Processes; Defining Run Parameters; Analysing results.

***Modelling Queuing & Inventory System:***

Introduction, Single Line Queuing System, Simulating Single Queues in the Software, Networks of Queueing Station – Station, Route and Sequence Modules in the Software, Modelling and (Q, R) Inventory Control Policy.

## IM 408 AUTOMATION & ROBOTICS

***Production Operations & Automation Strategies:***

Automation defined; Types of automation; Reasons for automation; Arguments for & against automation. Manufacturing industries; Types of production; Functions in manufacturing; Organization & information processing in manufacturing; Plant layout; Production concepts & mathematical models; *CIM, FMS/FMC,* Automation strategies.

***Automotive Type Automation***

Automated flow lines; Methods of work-part transport; Transfer mechanism; Buffer storage; Control functions; Automation for machining operations; Design & fabrication considerations.

***Analysis of Automated Flow Lines & Line Balancing:***

General terminology & analysis, Analysis of transfer lines without storage, Partial automation. The assembly process, Assembly systems, Manual assembly lines, The line balancing problem; Methods of line balancing: Largest candidate rule, Kilbridge & Wester's method, Ranked positional weights method.

***Automatic Control Systems and Components:***

*Basic elements of automatic control system, Levels of automation, Analysis of regulated and servo control systems, Sensors, Actuators, Data conversion, Mechanical components of automation.*

***Robotics Technology & Applications***

Robot anatomy, Robot Configurations, Accuracy & Repeatability, Robot specifications, End effectors, *Kinematics and Dynamics of a 2-link Manipulator,* Characteristics of Robot applications, Robot cell design, Types of Robot applications.

## IM 411 METHODS ENGINEERING

***Work Study:***

Definition; Objectives; Procedure; Process chart symbols; Outline process chart; Flow process charts; Multiple activity chart; Two handed chart; Critical Examination; Case studies & Application.

***Method Study:***

Introduction to work study, Techniques of work study and their relationship, Basic procedure of work study.

***Work Measurement:***

Definition; Objectives; Techniques of work measurement; Stop watch time study; Timing methods; Performance rating; Standard timing; Allowance factors. Work sampling; Confidence level; Determination of sample size; Making random observations; Scope of work sampling.

Predetermined time standards; Definition; Advantages and criticisms; Motion classification; TMU; Use of PTS systems. Introduction to project management.

***Methods and movements at the workplace:***

General considerations, the principles of motion economy, Classification of movements, Re-organization of a workplace by means of a two-handed process chart, Micro-motion study, Simo chart, Use of films in methods analysis, The development of improved methods.

***Ergonomics:***

Human and working environment Interaction, lighting, illumination design, noise and vibration, temperature, dust, humidity, comfort level. Machine controls and displays of dials, Scope of Ergonomics and its practice in Pakistan.

## IM 402 COMPUTER AIDED MANUFACTURING (CAM)

***Conventional Numerical Control:***

Introduction, principles of Numerical Control, Hardware for Numerical Control, NC positioning systems, NC motion control systems, applications of numerical control, economics and justification.

***NC Part Programming:***

Manual part programming, computer assisted part programming, Lathe CAM Designer, Mill CAM, NC programming with interactive graphics.

***Computer Controls in NC:***

Problems with conventional NC, NC controller of technology, computer numerical control, direct numerical control, adaptive control machining systems, trends and new developments in NC.

***Group Technology and Process Planning:***

Part families, methods for developing part families; parts classification and coding, Hierarchical code, Attribute code, Hybrid code, introduction to various available classification and coding systems, Selecting a coding system, production flow analysis, benefits of group technology, machining cells. The role of process planning in CAD / CAM integration, Approaches to process planning: Manual approach, Variant approach, Generative approach; introduction to various process planning systems.

***Programmable Logic Controllers (PLC's):***

Functions of controllers, control devices, Programmable Logic Controllers: relay device components, switch, relay, counters, timers, relay logic, Programmable Controller Architecture: processor, memory, input /output, power supply, peripherals, Programming a Programmable Logic Controller: ladder diagram, ladder logic, timers and counters, programming examples.

***Design for Manufacturing (DFM):***

The meaning of DFM, schemes for DFM, axiomatic design, DFM guidelines, design for assembly, Taguchi method for Robust design, manufacturing process design rules, failure mode and effects analysis, summary of DFM tools.

## IM 405 FINITE ELEMENT ANALYSIS

***Introduction:***

The early use of Finite Elements, matrix forces method, matrix stiffness method, interim period, variational principles and Finite Elements, recent developments.

***Variational Formulation and Approximation:***

Boundary and Initial-Value problems, gradient and divergence theorems, functional, variational symbol. Variational formulation of boundary-value problem, Variational Method of Approximation, Ritz method, method of weighted residuals, time-dependent problems.

***Finite Element Analysis of One-dimensional Problems:***

Basic Steps in FEA; Modeling, Discretization, Connectivity of Elements, Imposition of Boundary Conditions, Solutions & Post Processing; Applications to Heat Transfer, Fluid Mechanics, & solid Mechanics Problems.

***Finite Element Error Analysis:***

Approximation Errors, Various Measures of Errors, Convergence of Solutions, Accuracy of Solutions.

***Numerical Integration & Computer Implementation:***

Isoperimetric Formulations, Numerical Integration, Natural Coordinates, Computer Implementation (Pre-processor, Processor, and Post-processor)

***Interpolating Functions, Numerical Integration & Modeling Considerations:***

Interpolating Techniques; Triangular, Rectangular, & Serendipity Elements; Coordinate Transformation; Integration on a Master Element; Modeling, Mesh Generation, Load Representation.

***Plane Elasticity:***

Assumptions of Plane Elasticity; Basic Equations, Weak Formulations; Principle of Virtual Displacement in Matrix Form; Finite Element Model, Matrix & Weak Form Model; Evaluation of Integrals.

## MG 450 PRINCIPLES OF SUPPLY CHAIN MANAGEMENT

***Introduction to Supply Chain:***

Introduction to logistic & supply chain management, Internal and external supply chain, Operational issues.

***Value of Information:***

Value for Information, Information Technology in Supply Chain.

***Modeling of Supply Chain:***

Supply Chain Modeling, Coordinate Product and Supply Chain Management.

***Decision Making:***

Decision Support System for Supply Chain, Customer Value, International Supply Chain Management, and Inventory Management.

## IM 413 PLANT ENGINEERING

***Thermal Power Plants:***

Basic principles and cycles used; Steam power plants; Diesel power plants; gas power plants; combined heat and power generation.

***Internal Combustion Engines:***

Basic Internal Engine Types: Spark ignition engines; Compression Ignition engines; speed and load control; supercharging. Idealized cycle and processes; Otto cycle; Diesel cycle. Fuels, high and heavy fuel oil.

***Steam Generators and Turbines:***

Properties of Steam; Enthalpy and entropy diagram; Rankine cycle, Steam Power Plant: Boilers; Feedwater pump; Air Pre-heaters; Economizers; Super-heaters; Condensers. Boiler Types: Fire tube and water tube designs. Steam turbines; impulse and reaction types; back-pressure and extractive turbines.

***Air-conditioning and Ventilation:***

Principles of air-conditioning; Comfort and industrial air-conditioning; refrigeration equipment; primary and secondary refrigerants; ventilation equipment. Psychometric chart and its use; calculation of the simple air-conditioning system. Temperature and humidity control; pneumatic, electric and hydraulic systems

## IM 417 HEALTH SAFETY & ENVIRONMENT

***Safety Management:***

Understanding accident and hazard, Hazard control and loss control, Company policy and management responsibilities, Direct and indirect cost, Accident causes and their control, Principles and processes of lost control, Knowledge of existing safety codes and standards.

***Hazards and Risk:***

Hazards and identification, Risk Assessment, Risk Control

***Accident Prevention and Control:***

Fire safety, Electrical Safety, Safety in boilers and unfired pressure vessels and high pressure systems, Safety in material handling and storage, Safety in production operations

***Industrial Hygiene and worker protection:***

Understanding industrial hygiene, Various hazards encountered in workplace, Types of personal protective equipment (PPE), Availability in market their design standards and selection criteria.

***Process Safety Management:***

Development of facility operation and procedures, Analysis of process hazard, Permit to work systems, Hazard communication (Material Safety Data Sheet), Chemical inventory record, Accident reporting and investigation, OHSAS 18001:1999

***Environment Management:***

Environment pollution, Air emission management, Waste management, Waste water treatment and control, Soil and ground water protection, Introduction to Pakistan Environment Protection Act 1997 and National Environmental Quality Standards, Key elements of ISO 14000.

## MT 441 ADVANCED MATHEMATICAL TECHNIQUES

***Complex Variable:***

Limit, continuity, zeros and poles of a complex function. Cauchy-Reimann equations, conformal transformation, contour integration.

***Error Analysis:***

Types of errors (relative, Absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart.
Use any Computational tools to Analysis the Numerical Solutions.

***Finite Difference:***

Functions of operators, difference operators and the derivative operators, identities. Linear homogeneous and non-homogeneous difference equations. Numerical Differentiation, Forward Difference Method, Backward Difference Method, Central Difference Method.

***Interpolation & Curve Fitting:***

Lagrange's, Newton, Hermit, Spline, least squares approximation. (Linear and non-linear curves). With numerical problem in engineering.

***Numerical Integration & Differentiation:***

Computation of integrals using simple Trapezoidal rule, $\frac{1}{3}th$ Simpson's rule, $\frac{3}{8}th$ Simpson's rule, Composite Simpson's and Trapezoidal rules, computation of solutions of differential equations using (Euler method, Euler modified method, Runge Kutta method of order 4).

***Improper integrals:***

Definitions, Types of improper integral and their convergence.

***Elliptic Integrals:***

Introduction and identification of elementary elliptic integrals of first, second and third kinds. Simple applications.

## IM 409 MANUFACTURING ENGINEERING PROJECTS

Selected problems requiring design, manufacturing, development of problem specific software, preparation of drawings, fabrication of prototype / models and laboratory experimentation shall be assigned to individual students or groups of students. Grading shall be based on the reports produced by individual students and their critical evaluation through an oral examination.

## HS 403 ENTREPRNEURSHIP

***Understanding the Entrepreneurship Mind-set:***

- The revolution impact of Entrepreneurship
- The individual Entrepreneurship Mind-set
- Corporate Entrepreneurship Mind-set
- The Social and Ethical perspectives of Entrepreneurship

***Launching Entrepreneurship Ventures:***

- Creativity and innovations
- Methods to initiate ventures
- Legal challenges in Entrepreneurship
- The search for Entrepreneurship

***Capital Formulation of Entrepreneurship Plan:***

- The assessment of function with opportunities
- The marketing aspects of new ventures
- Financial statements in new ventures
- Business plan preparation for new ventures

***Strategic Perspectives in Entrepreneurship:***

- Strategies growth in Entrepreneurship
- Valuation challenges in Entrepreneurship
- Final harvest of a new venture

***Teaching Methodology:***

**Lectures: Interspersed with interactive sessions in class Practical work: Spoken language, pronunciation, accent reduction, discussion etc.**

## *IM 416 MANAGEMENT INFORMATION SYSTEMS

***Introduction;***

Overview of System and Sub-systems, Information Systems, Relevance of Information Systems to organizational decision making, Information Systems and Manufacturing Environment Responsibilities of an Industrial Engineer from MRP to ERP and beyond.

***Tools and Technologies;***

Data Flow Diagrams, Functional Flow Diagrams, System Flow Charting, UML Diagrams, Bar Coding Technology, RFIDs, Formal Documentation and Presentation Formats.

***Information and Data Base Management Systems;***

Data Handling Procedures, Database; their Types and Design Issues including Modeling (ER Diagram etc.) and Normalization, Data Base Management Systems, Data Base Software, Client-Server vs. Distributed Computing, Methods of Data Collection, System Development Life Cycle (SDLC), Feasibility Study Considerations, Effects and Usages of Internet in Manufacturing Industry.

## *IM 418 CONDITION MONITORING

***Mechanical Vibration· Fundamentals:***

Harmonic motion, Single & multi degree of Freedom (dof), Free and forced vibration, Damped and un-damped vibration, Rotational unbalance, Foundation force and transmissibility, Transverse Vibration, Whirling of Shafts, Self-excited vibration.

***Condition Monitoring Basics:***

Maintenance strategies, Condition based maintenance, Key features of Condition monitoring, When to use and how to implement condition monitoring.

***Vibration Measurement & Control:***

Vibration measurement system, Transducers and instrumentation, Vibration monitoring, Spectral Analysis and Control.

***Condition Monitoring Techniques:***

Monitoring of vibration, Wear-Debri Analysis, Oil and Lubricant analysis Oil/ debris, Current, Conductivity, Insulation, Performance, Thermography, Acoustic and ultra-sonic emission, Corrosion and Visual & manual inspection.

***Condition Monitoring Case Studies:***

Case studies related to static and rotating industrial equipment such as induction motors, Rotor dynamic pumps and reciprocating machines.

## *IM 419 PROJECT MANAGEMENT

***Project Management Framework:***

Definition of Projects and Project Management, Projects versus Operations, Project Management versus Classical/Operations Management, Evolution of Project Management, Project Life Cycle and its differences with Product Life Cycle, Forms of Organizational Structures and their impact on Project Management, Project Management Methodology, Project Initiation and Project Charter, Project Planning Process, Types of Plans.

***Project Scope Management:***

Scope Statement, Work Breakdown Structure, Work Packages.

***Project Scheduling:***

Listing Activities, Developing a Network, Types of Network Diagrams, Duration Estimation, CPM/PERT and their differences, Constructing the Critical Path, Critical Path Analysis, Gantt Charts, Project Schedule Compression Techniques, Project Crashing.

***Project Budgeting:***

Creating a Project Budget, Top-Down Budgeting, Bottom-Up Budgeting, Activity-Based Costing.

***Project Execution, Monitoring and Closing:***

Project Execution Process, Issues during Project Monitoring, Project Control, Project Closing Process, Lessons Learned.