FIRST SEMESTER MECHANICAL ENGINEERING
### SCHEME OF STUDIES FOR FIRST SEMESTER B.Sc. MECHANICAL ENGINEERING

<table>
<thead>
<tr>
<th>No.</th>
<th>Course</th>
<th>Contact Hours</th>
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<td></td>
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<td>Theory</td>
<td>Lab</td>
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<td>BSI-101</td>
<td>Islamic Studies</td>
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<td>BSI-110</td>
<td>Pakistan Studies</td>
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<td>Electrical Technology</td>
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<td>English Composition &amp; Comprehension</td>
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Course No. BSI-101  
Islamic Studies (2, 0)

Chapter-1  
Subjective study of the Holy Quran & Hadith

1. Fundamental Doctrine of Islam  
   a. Tawheed (Oneness of Allah)  
   b. Prophethood  
   c. The day of Judgment
2. Ibadaat (Workships)  
   a. Salat or Namaz  
   b. Zakat  
   c. Saum (Fasting)  
   d. Hajj
3. Amar Bil Maroof and Nahi Anil Munkir (commands and Prohibition)  
   a. Importance of Preaching  
   b. How to Preach
4. Unity of Ummah
5. Kasb-I-Halal (Lawful Earning)
6. Fundamental Human Rights  
   a. Right to Life  
   b. Right to Property  
   c. Right to Protect one’s Honour  
   d. Right to Faith  
   e. Right to Equality  
   f. Right to Economic Security  
   g. Right to Merit  
   h. Right to Justice
7. Rights of Women
8. Relation with the Non-Muslims
9. Khutba Hujjatul Wida (Farewell Address)

Chapter-II  
The Life of the Holy Prophet (PBUH)

1. Birth of the Holy Prophet (PBUH)  
2. Life before Prophethood  
3. Prophethood  
4. Preaching and Difficulties  
5. The Hijrah (Migration to Al-Madina)
6. Brotherhood and Treaty of Al-Madina
7. Ghazwat-e-Nabavi (Holy Wars)
   a. Ghazwah-e-Badar
   b. Ghazwah-e-Uhad
   c. Ghazwah-e-Ahzab
   d. Sulah-Hudaibiyah
   e. Conquest of Makkah-al-Mukaramah
   f. Ghazwah-e-Hunain
   g. Ghazwah-e-Tabook
8. Hajjat-ul-Wida
9. Death of the Holy Prophet (PBUH)

Chapter-III

Islamic Civilization

1. Influence of Islamic Civilization on the sub-continent
   a. Definition of civilization
   b. Civilization of sub-continent before Islam
   c. Fundamentals and Elements of Islamic Civilization
      i. Social Changes
      ii. Moral Influence
      iii. Political Consequences
      iv. Effect on Family Life
2. International Influence of Islamic Civilization
   a. Islam and Scientific knowledge
   b. Influence on Human Thought
   c. Social and Humanistic Effects
Course No. BSI-110  
Pakistan Studies (2, 0)

Aims and Objectives for the creation of Pakistan, Pakistan Ideology, definitions. Ideology in the light of sayings of Quaid-e- Azam and Iqbal.

Reformist Movement in Subcontinent, Shah Waliullah , Sheikh Ahmad Sirhindi, and Syed Ahmad Shaheed.  

Quaid-e-Azam 14 points 1929.  
Allama Mohammad Iqbal Address 1930.

Act of 1935, Federation.  
The Rule of Congress ministries.

Pakistan Resolution 1940.  
Simla conference 1945.

Cabinet Mission Plan, June 3 Plan 1947.  
Initial Problems of Pakistan.  
Constitutional developments in Pakistan.  
The Constitution of 1973

Natural Resources  
Geo-Strategic Importance of Pakistan  
Pakistan’s Relations with neighboring countries.  
The concept of Human Rights.
Course No. BSI-122
Calculus (3, 0)

Single Variable Calculus: Basic concept of single variable function, Continuous, discontinuous and piecewise continuous functions, Periodic, odd and even functions, algebraic functions, Transcendental functions and its graphical representations, Applications of functions in our daily life situations.

Differential Calculus:
Limits and continuity, Interpretation of a derivative, Geometric interpretation, Total differential and its applications in our daily life situations, The use of a table of different type derivatives, Higher order derivatives, Tangents and normals, Approximation of a function at a particular point by Taylor’s and Maclaurin’s series, Maximum and Minimum values of a function, The first derivative test, The second derivative test, Point of inflexion and its applications in business and engineering.

Integral Calculus:
Basic concepts of integration, A table of integral formulas, Some rules of integration, Definite integrals, The area bounded by a curve, Integration by parts, Integration as the limit of a sum, Volume of revolution, and its applications in our daily life situations.

Multivariate Calculus:

Recommended Books:
Course No. BSI-109
Electrical Technology (3, 3)

Introduction to DC Circuits
Series and parallel Circuits, DC Circuit Theorems

Theory of Alternating Current
Series and parallel Circuits, Resistance, Inductance and capacitance of AC Circuits, Power Triangle.

Introduction to Transformers

House hold and Industrial Wiring
Elements of house and power wiring, testing of house and industrial wiring.

Basic Electronics
Semiconductors, P-Type and N-Type Materials, Electrons and Holes, P-N Junction, Diodes, Diode Circuits, Transistors, Use of Transistor as a Switch, Operational Amplifiers., and their use in circuits.

Electrical Motors
Different Electrical motors and their selection criterion under different conditions (DC motors, AC motors and servos, Stepper motors etc), Electrical Traction and Braking, Efficiency.

Electric Furnaces
Types and working,

Recommended Books:
1. Electric Circuits, Basic Electricity by Schaum’s Series
2. Electric Machinery Fundamentals by S. Champman
3. Electrical power Technology by Theodore Wildi
Course No. ME-106
Engineering Workshops (0, 3)

Part-1

Basic Processes in Fitter Shop
Filling, Sawing, Drilling, Dies and Tapping, Reaming, Marking

Basic Processes in Wood Work Shop

Basics of Electric Shop

Functions of Forge & Foundry Shop

Machine Shop
Introduction to Machine Tools, Basic Lath operations including turning, Facing, Screw Cutting, Lathe Parts and Accessories.

Welding
Introduction to soldering, Brazing and Welding, Brief Details of Gas, and Electric Arc Welding, Spot Welding

Part –II (Theory)

Joining Process & Equipment

Recommended Books:

2. Electrical Wiring by Richter and Schwan.
3. Wiring Manual by Pak Cables, Limite
Course No. ME-107
English Composition and Comprehension (3, 0)

English Composition

Elementary rules of usage, Elementary rules of composition, words and expressions, rules of grammar, writing summaries, writing practice

English Comprehension

Getting the Essential Information, Finding the Main Idea, Difference between Fact and Opinion, Chronological Order, Order of Importance, Cause and Effect, Style: How to Say It, Finding the Implied Main Idea, Critical Reading, Critical Thinking, Reading across the Curriculum, Drawing Conclusions, Preparing for tests.

Course No. ME-108
Computer Programming Lab (0,6)

Introduction to Computers
Use of Windows and MS Office

Programming in C and Visual Basic
Data Types, Arithmetic Operators and Functions, Assignment Statements, Input/Output Statements, Logical Statements, Branching Loops, Arrays and Subscripts, Functions and Subroutines, File Handling.

Practical Exercises in Computer Programming. Introduction and Practice of a Mathematical Package B.G. MATLAB.

Recommended Books:

To be arranged by the instructor.
SECOND SEMESTER
MECHANICAL ENGINEERING
## SCHEME OF STUDIES FOR SECOND SEMESTER B.Sc MECHANICAL ENGINEERING

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<td>Technical Writing &amp; Communication Skills</td>
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<td>Engineering Drawing &amp; Graphics</td>
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<td>EE-119</td>
<td>Digital Logic and Design</td>
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Ordinary Differential Equations:
Basic concepts of ordinary differential equation, General and particular solutions, Initial and boundary conditions, Linear and nonlinear differential equations, Solution of first order differential equation by separable variables and its applications in our daily life situations, The techniques like change of variable, homogeneous, nonhomogeneous, exact, non-exact, linear and nonlinear Bernoulli could be used in case of complications. Solution of second order differential equation by theory of operators and its applications as forced and free oscillations, The extension of second order solution criteria to higher order differential equations, Solution of the system of differential equations by theory of operators and its applications in our daily life situations, Laplace solution of ordinary differential equations.

Partial Differential Equations:

Analytic solution by separation of variables of the Steady-state Two-Dimensional Heat equation/Laplace equation and Unsteady-State One-Dimensional Heat equation/Diffusion equation with homogeneous and nonhomogeneous boundary conditions. D’ Alembert’s solution of two-dimensional wave equation with homogeneous and nonhomogeneous boundary conditions.

Fourier Series:
Periodic waveforms and their Fourier representations, Calculating a Fourier series, Fourier series of odd and even functions, Half range Fourier series, Fourier series solution p.d.equations.

Recommended Books:
1. Modern Differential Equations Second Ed. By Abell and Braselton, Brooks/Cole
Course No. ME-101
Engineering Statics (3, 0)

**Force Systems**
Force, Rectangular Components, Moment, Resultant Couple (Two and Three Dimensional Systems).

**Equilibrium**
Free Body Diagrams, Equilibrium Conditions for two and three Dimensional Systems.

**Structures**
Plane Trusses, Method of Joints, Method of Sections.

**Friction**
Types of Friction, Dry Friction, wedges, Cone, Plate and Collar Bearings.

**Recommended Book:**

Course No. ME-102
Fluid Mechanics-I (3, 0)

**Introduction**
Definition of Fluid, Density, Specific Weight, Specific Volume, Specific Gravity, Surface Tension, Compressibility and Viscosity of Fluid.

**Fluid Statics**
Pascal’s Law, Pressure Head, Different Pressure Gauges, Hydrostatic Forces on Submerged Planes and Curved Surfaces, Buoyancy and Stability of Submerged and Floating Bodies. Fluid Mass Under Acceleration.

**Types of Flow**

**Basic Equations And Their Application**

**Flow Through Pipes**

**Open Channels**

**Recommended Books:**

2. Fluid Mechanics and Hydraulic Machinery, By K. R. Arora, Standard Publisher, India.
Course No. ME-104
Technical Writing and Communication Skills (3, 0)

Part One

Technical Writing

Overview of the technical writing process. Writing Letters Memos and Minutes, Applying for a job and resumes, Writing Feasibility and Progress Reports, Writing Proposals, Writing Technical Reports.

Part Two

Communication Skills

The nature of communication, Team communications, Appearing for an interview, Oral presentations, Persuasive Presentations, Conducting meetings, Listening.

Recommended books:

Course No. ME-105  
Engineering Drawing and Graphics (2, 3)

Introduction to engineering drawing, Various types of lines, Basic geometrical constructions, Conic sections, Theory of orthographic projection, Dimensioning and lettering, Introduction to tolerance, Projections of points, Projections of straight lines, Projections of planes and solids in simple position, sectioning of solids, Isometric projections, Development of surfaces.

Recommended Books:

2. Elementary Engineering Drawing by N.D. Bhatt

Course No. ME-105  
Engineering Drawing and Graphics (Lab)

Introduction to drawing instruments and their use, various scales, Practice of orthographic projection, Missing lines in orthographic projection, drawing three views of different objects, Practice of dimensioning and lettering, Practice of sectioning, Conversion of orthographic projection into isometric view, creating drawings of engineering fasteners like rivets, cotter joint, threads etc.

Recommended Books:

2. First Year Engineering Drawing by A. C. Parkinson.
Course No. EE-119  
Digital Logic Design (3, 3)

1. Number System

Binary, octal, hex & BCD etc. addition & subtraction in various codes, conversion from one code to another, Boolean algebra.

2. Logic and digital Design

Logic system, logic gates, basic logic equations, logical operators and truth tables. Demorgan’s Theorem, Boolean algebra, minimization techniques, Karnaugh maps up to four variables.

3. Combinational & sequential Logic

Adders, Subtractors, the arithmetic logic unit, speeding up the addition (e.g. carry look ahead adder). Multiplexer, demultiplexer, decoder, encoder, the magnitude comparator, flip flops, synchronous and asynchronous sequential circuits, counters.

4. Building Block with Memory

Data storage, concept of one bit memory using flip flop, three state outputs, RAM, ROM, PROM, EROM, EEPROM

5. Microprocessor

The bus, controller, hardware & Micro programmed controller, data movement, timing movement (leading to 8085 Microprocessor). Introduction to machine and assembly language. Introduction to 8085 architecture.

Recommended Books:

1. Digital Computer Fundamentals by Moris Mano
2. Digital Computer by Malvino
3. Electronic Devices, by Floyd, Prentice Hall
Course No. EE-119
Digital Logic Design (Lab)

1. Familiarization to logic trainer, IC’s Pins numbering, verification of truth tables for NOT, NAND, NOR Gates.
2. Versatility of Gates:
   A-Use of NAND as NOT Gate.
   B-Use of NAND as AND Gate.
   C-Use of NAND as OR Gate.
   D-Use of NAND as NOR Gate.
   E-Use of NOR Gate as NOT Gate.
   F-Use of NOR Gate as OR Gate.
   G-Use of NOR Gate as NAND Gate.
   H-Use of NOR Gate as AND Gate.
3. Use of Boolean postulates/ Theorems & Karnaph Map in simplifying Logic Functions.
8. Design & Implementation of 4-1 Multiplexer.
10. Design & Implementation of 4 Bit Adder/ Subtract or.
13. Shift Registers.
14. 4 Bit Binary Ripple Counter.
15. Up/Down Counter.
16. Presettable Synchronous Counter.
17. Memory Cell.
THIRD SEMESTER MECHANICAL ENGINEERING
## SCHEME OF STUDIES FOR THIRD SEMESTER B.Sc MECHANICAL ENGINEERING

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### Course No. BSI-111

- **Course Name**: Linear Algebra
- **Contact Hours**: Theory - 3, Lab - 0, Total - 3
- **Credit Hours**: Theory - 3, Lab - 0, Total - 3

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Linear Algebra (3, 0)

Vector Algebra:
Introduction to scalars and vectors, Vectors in the plane, Scalar and vector products, Lines in $\mathbb{R}^2$, $\mathbb{R}^3$ and planes, Spheres, Orthogonal projections, Perpendicular distance from a point to a line and a plane, Vector spaces, Subspaces, Linear combinations, Linearly dependent and Independent set of vectors, Spanning of a vector spaces, Bases of a vector spaces and its applications in engineering and Business.

Matrix Algebra:
Introduction to matrices, Matrix operations, Inverse Matrix, Rank of a Matrix, Echelon form of a Matrix and its applications in our daily life situation problems, i.e. in line-communication as Air-lines, Telephone-lines, Connecting cities by roads.

Determinants:
Determinants and its properties, Inverse of a matrix, Rank of a matrix, Linearly dependent and independent by determinants.

Linear System of Equations:

Linear Transformations:
Reflection operators, Projection operators, Rotation operators, Shear in x and y directions, Dilation and Contraction.

Eigenvalues and Eigenvectors:
Eigenvalues and eigenvectors and its applications as deformation, Markov processes as Mass-transit problems, Forecasting of a weather and to develop the solution of the system of differential equations for mechanical system/electrical system and civil engineering, specially in public health engineering problems.

Recommended Books:

Course No. ME-201
Engineering Dynamics (3, 3)

Kinematics of Particles
Rectilinear Motion, Plane Curvilinear Motion, Rectangular Coordinates, Normal and Tangential Coordinates, Polar Coordinates, Space Curvilinear Motion.

Kinetics of Particles

Recommended Book:

Course No. ME-201
Engineering Dynamics (Lab)
1. To verify the link polygon for various uniplanar forces.
2. To determine tension in various parts of a hanging cord.
3. To verify the principle of moments on a bent lever.
4. To verify the principle of moments on dics apparatus.
5. To calculate supporting reactions in a simple supported beam.
6. To find forces developed in various parts of a simple roof truss.
7. To find forces developed in various parts of a wall crane.
8. To calculate moment of inertia of a flywheel by falling-weight method.
9. To calculate moment of inertia of a wheel by rolling it down an inclined plane.
10. To calculate coefficient of friction between two materials on an inclined plane.
11. To calculate the coefficient of friction between the given belts and the cast iron pulley.
12. To calculate efficiency and to draw load-efficiency curve for a screw jack.
13. To draw load-efficiency curve for a simple lifting crab.
14. To draw load-efficiency curve for a worm and worm wheel (helical block)
15. To draw load-efficiency curve for a wheel and axle.
16. To determine centre of gravity of an irregular shaped body.

Course No. ME-202
Fluid Mechanics-II (3, 3)

Introduction
Basic Laws of Fluid Mechanics, General Forms of Continuity, Momentum and Energy Equations for Control Volume.

Fluid Kinematics

Fluid Dynamics

Compressible Flow
Elements of one dimensional gas dynamics, speed of sound, Mach number and Mach cone, local and stagnation properties, isentropic flow through duct, isentropic flow through convergent, convergent-Divergent nozzles.

Hydraulic Machinery and Equipment

Recommended Books:
4. Fluid Power with Application, By Anthony Esposito.
Course No. ME-202
Fluid Mechanics-II (Lab)

1. To find out the impact of jet on flat and curved vanes.
2. To test the performance of single stage centrifugal pump running at design speed.
3. To test the performance of two similar pumps connected in series and parallel configuration.
4. To test the performance of Pelton Wheel.
5. To study the laminar and turbulent flow using the classical reynold apparatus.
6. To determine the center of pressure on a submerged plane surface.
7. To confirm the loss of head predicted by a pipe friction equation associated with flow of water through a smooth bore pipe.
8. To find the critical velocity for flow through pipe using pipe friction apparatus.
10. To determine the coefficient of Venturimeter.
11. To calibrate the given pressure gauge.
12. To calibrate the given rectangular notch.
13. To calibrate a triangular notch.
14. To find the co-efficient of discharge of a circular orifice by energy method.
15. To study the stability of a pantoon.
16. To study various devices for measuring pressure.
Course No. ME-203
Solid Mechanics–I (3, 0)


Recommended Books:
ME-115
CAD-I (Practical)

Introduction to AutoCAD 2002, Start, Organize and Save a Drawing, Moving around in an Existing Drawing.

Understanding and Drawing simple 2D objects, Coordinate systems, Point data entry, Drawing Point, Line, Circle, Arc, Rectangle, Polygon, Ellipse, Polyline, etc., Drawing with Precision. Modifying Drawing Objects. Creating Copies of Objects.

Drawing in Layers, Object Properties

Creating complex drawings, hatching, text, dimensions, blocks (with and without attributes, external references, AutoCAD Design Center.

Creating simple 3D Objects, Solids and Surfaces. Extracting views from model space into paper space.


Recommended Books:

3. Mastering AutoCAD 2002 by George Omura
FOURTH SEMESTER MECHANICAL ENGINEERING
### SCHEME OF STUDIES FOR FOURTH SEMESTER B.Sc MECHANICAL ENGINEERING

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<td>ME-206</td>
<td>Thermodynamics</td>
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<td>ME-204</td>
<td>Solid Mechanics II</td>
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<td>ME-207</td>
<td>Engineering Metallurgy</td>
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<td>ME-215</td>
<td>Machine Design-I</td>
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Course No. BSI-242  
Numerical Analysis (3, 0)

Finite differences, Forward, backward and central differences and its operators form, **Interpolation and extrapolation**; Linear and higher order interpolating polynomials, Newton’s Gregory forward & backward difference interpolation formulas and its utilization as extrapolation, Lagranges interpolation, Numerical differentiation based on differences, **Numerical integration**; Trapezoidal and Simpson’s approximations, Romberg integration process, **Numerical Solution of non-linear equations**; Bracketing and iteration methods and its applications as multiple root methods, **Direct solution of the system of linear equations**; Gauss-elimination, Direct and indirect factorization, symmetric factorization, tridiagonal factorization, Iterative methods like Jacobi’s iteration and Gauss-Seidel iteration, **Numerical solution of initial value problems**; Single-step methods and its comparison with Taylor’s series expansion, Multi-step methods, Higher order differential equations, System of differential equations, **Numerical solution of linear and nonlinear boundary value problems**.

**Recommended Books:**

Course No: ME-206
Thermodynamics (3, 3)

**Basics of Thermodynamics:** The system, working substance, heat and work, state and properties, temperature scales, processes and cycles, PV diagram, Internal energy, specific heats, Ideal gas laws, equations of state, first law of thermodynamics, system and control volume concept. Application of conservation of energy principle to isobaric, isochoric, isothermal, adiabatic, isentropic and polytropic processes, Second law of thermodynamics and its consequences, reversibility, Heat engines, thermal efficiency of reversible and irreversible engines, the Carnot cycle, Concept of entropy and its application to flow and non-flow processes. Available and unavailable energy, isentropic process, enthalpy-entropy diagram.

**Physical Properties of Steam:** The formation of steam, the triple point, quality of steam, sub-cooled liquid, enthalpy of steam, steam tables, PV diagram for steam, the critical point, behavior of vapor in different thermodynamics processes.


**Recommended Books**
2. Fundamentals of Thermodynamics by Moran and Shapiro.
Course No. ME-204
Solid Mechanics-II (3, 3)


Recommended Books:

Course No. ME-204
Solid Mechanics–II (Lab)

1. To draw stress-strain diagram for steel specimen and find yield strength & ultimate strength
2. To find young’s modulus of elasticity for steel.
3. To verify experimentally flexure formula for pure bending & torsion formula for solid shafts.
4. To determine experimentally modulus of rigidity and poison ratio for steel.
Course No. ME-207
Engineering Metallurgy (3, 3)

Review of Atomic Structure in Solids

Metals and Alloy Systems.

Alloys and Equilibrium Diagrams

Heat Treatment
The Temperature Transformation Curve, Effect of Rate of Cooling, Shape, Mass, Quenching Media, Temperature and Time of Heating on Mechanical Properties, Annealing, Normalizing, Quenching, Tempering, Stabilizing and Spheroidizing.

Relationship Between Microstructure And Mechanical Properties

Recommended Books:
Course No. ME-207
Engineering Metallurgy (Lab)

1. To demonstrate the working of various equipments available in the metallurgy laboratory.
2. Preparation and macro-examination of given specimen.
4. Non-destructive test on a given specimen, using metropolitan crack-detector
5. Heat-treatment of steel specimens for annealing, normalizing, quenching and tempering and comparison of their hardness numbers.
6. Metallography of ferrous and non-ferrous specimens with a range of 50 to 1000 magnification.
7. To demonstrate the working of “Carbon percentage analyzer”.
8. Top sort-out the metals by:
   a. Sound-tests.
   b. Spark-test

Course No. ME-215
Machine Design–I (3, 0)


Recommended Books:

FIFTH SEMESTER MECHANICAL ENGINEERING
### Semester 5

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<td>Mechanics of Machines &amp; Vibration</td>
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<td>ME- 302</td>
<td>Small Business Development &amp; Entrepreneurship</td>
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<td>Machine Design-II</td>
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<td>ME- 309</td>
<td>Engineering Economics</td>
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<tr>
<td>ME- 315</td>
<td>CAD-II Lab</td>
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**Total Contact Hours**: 15 9

**Total Credit Hours**: 15 3 18
Course No. ME-301  
Mechanics of Machines & Vibrations (3, 3)

Introduction, Simple, Compound, and Epicyclical Gear Trains; Analysis and Design of Cams; Balancing of Rotating and Reciprocating Masses.

Oscillatory Motion
Harmonic Motion, Periodic Motion, Vibration Terminology.

Free Vibrations

Two Degree of Freedom System

Recommended Books:

2. Design of Machinery by Norton
3. Mechanical Vibrations Theory & Applications by W.T. Thomson
4. Mechanical Vibrations by Schaum’s Outline Series
Course No. ME-301
Mechanics of Machines & Vibrations (Lab)

1. To draw the displacement-time curve, and the profile of the cam from the given cam-follower apparatus.
2. To balance the disturbing masses in single and several planes using balancing machine.
3. To Verify Centrifugal force Law
4. To find relationship between Torque and Twist using Torsion Bar Apparatus
5. Study and demonstration of the following mechanisms:
   a. Simple reciprocating engine mechanism.
   b. Scotch yoke (Double slider-crank-chain mechanism)
6. To study the vibration characteristics of undamped single degree of freedom system.
7. To find relationship between force and displacement for compression spring
8. To find relationship between force and displacement for extension spring.
9. To study the effect of damping on the natural frequency of a spring mass system.
10. To find the damping coefficient of a damped spring mass system by logarithmic decrement method.
11. To determine the fundamental natural frequency of a cantilever beam.
Course Objectives:
Starting and operating a new business involve considerable risk and effort to overcome the inertia against creating something new. In creating and growing a new venture, the entrepreneur assumes the responsibility and risks for its development and survival and enjoys the corresponding rewards. At the end the participants will be able to explain the process of Entrepreneurship and Small Business Management and be able to develop business plan to start their own ventures.

Contents:

The Entrepreneurial Process

Creating and Starting the Venture
Creativity and sources of new business ideas, Methods of generating ideas, Creative problem Solving, Recognizing the difference between ideas and opportunity and creativity. Assessing business opportunities in Pakistan. Screening and evaluating opportunities (Macro and Micro screening). Analysis of idea/opportunity (SWOT), Product planning and development process. Creating parallel competition by developing a similar product or service (Competition and Collaboration: X/Y Exercise), Product life cycle, Finding sponsorship. Acquiring a going concern, E-Commerce and business start-up and growth.

Market Opportunities and Marketing
Marketing as a philosophy, Marketing management: Creating a marketing plan, Market room simulation (exercise), Analyzing the environmental situation and the market opportunity, Setting marketing objective, Formulating a marketing strategy, Creating an action plan to implement the marketing practices.

Creating a Successful Business Plan
The business plan as selling document, Eight reasons for writing a business plan, How long the business should plan be?, What should be business plan cover. The executive summary: your guiding light, The company: What's your

**External Assistance for startups and small Businesses.**
Why you should consider external assistance program, External assistance available in Pakistan (field work), External assistance for special groups, locations, and industries (field work), Review of the fieldwork.

**Franchising.**
What is franchising? Becoming *a* franchisee versus starting a stand-alone business, The franchisee contract, Non-contractual considerations of buying a franchise, Limitations of franchising, Conclusion, Course evaluation.

**Recommended Text Books**
2. S.S. Khanka, *Entrepreneurial Development*
Course No. ME-305  
Machine Design–II (3, 0)


Recommended Books:

Course No. ME-309  
Engineering Economics (3, 0)


Recommended Books:
1. Engineering Economics Analysis by Donald G Newnan  
3. Engineering Economy Mc-Grawhill by Anthony J Tarquin and Blank  
4. Engineering Economy by White
Course No. ME-307
Engineering Materials (3, 0)

Composite Materials

Ceramic Materials

Polymers
Introduction, Classification of Polymers, Representing the Structure of Polymers, Chain Formation by the Addition Mechanism, Degree of Polymerization, Chain Formation by Condensation Mechanism, Deformation Thermoplastic Polymers, Effect of Temperature on Behavior of Thermoplastics, Controlling the Structure and Properties of Thermoplastics, Elastomers (Rubbers), Additives to Polymers, Forming of Polymers.

Corrosion And Wear

Electronic Materials

Recommended Books:
Course No. ME-315
CAD-II (Practical)

3D Modeling, Assembly & Drawing using a CAD Package. (Pro/Engineer)

Use of Finite Element Analysis Packages to Solve Linear Static and Dynamic Problems. (ANSYS)
SIXTH SEMESTER MECHANICAL ENGINEERING
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<td>ME- 308</td>
<td>Quality Engineering</td>
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<td>Power Plants-I</td>
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<td>ME- 303</td>
<td>Mechatronics</td>
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<td>ME- 304</td>
<td>Manufacturing Processes</td>
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| Total Contact Hours | 14 | 9 |
| Total Credit Hours  | 14 | 3 | 17 |
Course No. ME-403
Ethical and Legal Dimension of Engineering (1, 0)

Introduction to professional and socioeconomic concepts essential to successful engineering practice and in preparation for senior design courses. Ethical codes of conduct are presented and case studies discussed with an emphasis on safety and public welfare. Relevant concepts in contract law, torts, professional and product liability as they relate to engineering practice are discussed.

Recommended Books:

1. To be arranged by the instructor.
Course No. ME-308
Quality Engineering (3, 2)

Quality Fundamentals

Inspection & Gauging

SQC
Use of Binomial, Poisson and Normal Distributions. Sampling Plans, Single, Double & Multiple Control Charts; Inspection by Attributes, Inspection by Variable Reliability & Maintainability.

Industrial Applications

Introduction to Total Quality Management and its tools

Recommended Books:

2. Metrology for Engineers, By Galyer and Shobolt.
3. Total Quality Control, By A. V. Feignbaum, McGraw-Hill.
Course No. ME-306
Power Plants-I (3, 3)

Reciprocating Internal Combustion Engines

Positive Displacement Machines
Reciprocating Compressors, Reciprocating Compressor Including Clearance, Multi-Stage Compression, Steady-Flow Analysis, Rotary Machines, Vacuum Pumps, Air Motors.

Gas Turbine Cycles
The Components of Gas Turbine Plant, The Practical Open and Closed Gas Turbine Cycle (The Joule and Brayton Cycles); The Constant Pressure Cycle (Closed Cycle Gas Turbine) The Use of a Power Turbine; Parallel Flow Units, Modifications to the Basic Cycle; Intercooling; Reheating; heat Exchangers (Regeneration); Effect of Pressure Loss, Combustion.

Nozzles and Jet Propulsion
Jet Propulsion; Ram Jet, The Turbojet, The Turboprop, Rocket Propulsion.

Turbo Machinery

Recommended Books:

2. Basic Engineering Thermodynamics, By Rayner Joel. Longman.
1. To test the performance of the Stuart Diesel engine
2. To test the performance of the Crossly Diesel engine.
3. To test the performance of a petrol engine, model P 5660 Cussons
4. Experimental study of the performance of:
   a. A fan
   b. A blower
5. Experimental study of the performance of:
   a. A centrifugal compressor
   b. An axial-flow compressor
6. To study the working of Single-stage, Two-stage compressor with and without intercooling.
7. To test the performance of a gas turbine unit model. P. 9000/9001 Cussion.
8. Experimental study of the performance of a jet engine.
Course No. ME-303
Mechatronics (3, 3)

Computer Architecture

Interfacing
Ports, Input/Output, Analog to digital converter, Sampling theory, Digital analog converter, interfacing Switches, Leds, Stepper Motors and DC Motors to Micro-Controllers.

Recommended Books:

Course No. ME-303
Mechatronics (Lab)

1. Familiarization to architecture and facilities of SDK-85
2. To draw the flow chart & write 8085 assembly language Program to add few numbers.
3. To draw flow chart & write 8085 assembly language Program using subroutine on SDK-85 (Multiplying three numbers).
4. To draw flow chart & write 8085 assembly language Program to process an array of 256 addresses in ROM for C3 & storing result in RAM.
5. To draw flow chart & write 8085 assembly language Program to produce a delay of 30 sec in execution.
6. To draw flow chart & write 8085 assembly language Program to count no of 1’s in a byte.
7. To draw flow chart & write 8085 assembly language Program to scan 10 addresses in ROM & store in RAM in ascending/descending order.
Course No. ME-304
Manufacturing Processes (3, 3)

Metal Casting Process & Equipment

Bulk Deformation Processes

(Sheet Metal Forming)

Machine Processes for Producing Various Shapes

Abrasive Machining & Finishing Operations
Abrasive, Bonded Abrasives (Grinding Wheels), Grinding Process, Grinding Fluids, Design Considerations for Grinding, Ultrasonic Machining.

Non-Conventional Machining Process:
Machining, Electrochemical, Electrical Discharge Machining, Wire E D M.

Jigs & Fixtures
General Design Principle, Element of Jig, Locating Devices and Clamping Devices

Recommended Books:
1. Manufacturing Engineering and Technology by Kalpakjian
Course No. ME-304
Manufacturing Processes (Practical)

Conventional Lathe Machine:
1. Taper Turning by Compound Rest Method
2. Taper Turning by Setting over the tail stock
3. Taper Turning by Taper Turning attachment
4. Thread cutting by using the lead screw

Capstan Lathe Machine
1. To study the parts of capstan Lathe Machine
2. To make a threaded bolt using the capstan lathe machine

Milling machine
1. To study the parts of the milling machine
2. To make a spur gear using milling machine
3. To make grooves/slots and plain surfaces on milling machine

Shaper Machine
1. To study the parts of shaper machine
2. To make a rectangular part on shaper machine

Planning Machine
1. To study parts of the planner machine
2. To make grooves and flat surfaces on planner

Drilling Machine
1. To study parts of the sensitive drilling machine
2. Practicals regarding drilling operations such as counter boring, counter sinking, etc.

Grinding Machine
1. To study the parts of Universal cylindrical grinding machine
2. Practical to furnish a cylindrical surface.

Rapid Manufacturing
1. 3D scanning
2. Rapid Prototyping
SEVENTH
SEMESTER MECHANICAL
ENGINEERING
### SCHEME OF STUDIES FOR SEVENTH SEMESTER B.Sc MECHANICAL ENGINEERING

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<td>ME- 402</td>
<td>Production Automation</td>
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<td>Maintenance Engineering</td>
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<td>ME- 404</td>
<td>Heat and Mass Transfer</td>
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<td>Instrumentation</td>
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<td>Power Plants-II</td>
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Course No. ME-402
Production Automation (3, 3)

Automation

Hardware of Automation
Building Blocks of Automation, Robotics Geometry, kinematics, Drives and Motion Control. Uses of CNC Machining. Advantages, Machine Code, Machine Control, Programming, DNC, CNC.

Logic Controllers
Introduction to PLCs, PLC Application.

Recommended Books:
1. Automation, Production Systems, and CAM by M.R. Groover, (Prentice)
2. Robotics & Manufacturing Automation (2nd Ed.) by C.R. Asfahl. (John Wiley)
3. Computer Control of Machines and Processes by Bollinger and Duffie
4. Handbook of Industrial Engineering (2nd Ed.) by G. Salvendy. (John Wiley)

Course No. ME-402
Production Automation (Lab)

Practical No. 1: Study of Basic G. and M Codes and writing a program for absolute and incremental programming techniques.

Practical No. 2: To perform the following operations on CNC
  • Facing
  • Turning
  • Threading (Internal, External)
  • Boring

Practical No. 3: Establishing a coordinate system using work shifts and tools setting.
Course No. ME-403
Maintenance Engineering (2, 0)

Organization and control of maintenance systems; Maintenance policies and strategies; preventive maintenance; Predictive maintenance and condition improvement; Total productive maintenance; Reliability and failure analysis; Scheduling maintenance; unique challenges of Software maintenance; Maintenance performance measure and improvement.
Introduction

Conduction Heat Transfer - One Dimensional

Convection Heat Transfer

Radiation Heat Transfer

Heat Exchangers

Mass Transfer

Recommended Books:
Course No. ME-404
Heat and Mass Transfer (Practical)

1. To determine the thermal conductivity of a given metal specimen
2. To determine the conduction heat transfer in composite rods.
3. To determine the overall heat transfer coefficients and effectiveness of double-pipe heat exchangers.
4. To determine the heat transfer rates in parallel-flow and counter-flow heat exchangers.
5. To determine the emissivity of a given specimen.

Course No. ME-405
Instrumentation (1, 3)

Course No. ME-405
Instrumentation (Lab)

Potentiometric position Transducer and signal Conditioner
1. Sensitivity, resolution, linearity
2. Linear variable differential transformer (LVDT)
3. Calibration of the conditioner
4. Detection of the transducer/conditioner linearity

Position Transducer with encoder and signal conditioner
1. Characteristics of position transducer
2. Numerical position transducer
3. Photo electric transducer
4. Absolute encoder
5. Incremental encoder
6. Position and speed detection
7. Checking the measurement accuracy
8. Resolution

Proximity transducer and signal conditioner
1. Characteristics of Proximity transducer
2. Linear inductive proximity sensors
3. On-off inductive proximity sensors
4. On-off capacitive inductive proximity sensors
5. Signal conditioner for proximity sensors
6. Calibration of the signal conditioner
7. Detection of the “distance /voltage(sensor)” characteristic curve
8. Detection of the “distance /voltage (sensor + conditioner)” characteristic curve
9. Detection of the sensor conditioner linearity

Pressure transducer and signal conditioner
1. Characteristics of Pressure transducer
2. Pressure shift transducer
3. Piezoresistive transducer
4. Signal conditioner
5. Calibration of the signal conditioner
6. Detection of the “pressure/output voltage” characteristic curve of the transducer conditioner
7. Calculation of the linearity of the transducer-conditioner
8. Detection of the measurement variation at the transducer temperature
Detection of the measurement variation a the conditioner variation temperature variation

**Force transducer and signal conditioner**
1. Characteristics of force transducer
2. Transducer based on the elastic reaction
3. Sensors using resistive strain gages
4. Sensors using semiconductor resistive strain gages
5. Transducer based on piezoelectricity
6. Signal conditioner used as force transducer
7. Calibration of the signal conditioner
8. Detection of the “force/output voltage” characteristic curve
9. Detection of the measurement variation a the load cell temperature variation.
10. Detection of the measurement variation a the conditioner variation temperature

**Speed and acceleration transducer and signal conditioner**
1. Characteristics of speed and acceleration transducer
2. Sensitivity
3. Dynamic Range
4. Piezoelectric accelerometer
5. Signal conditioner
6. Detection of the “acceleration/output voltage” characteristic curve
7. Detection of the transducer conditioner linearity
8. Tachometric transducer
9. Detection of the tachometric constant
10. Detection of the “speed/voltage” characteristic curve
11. Detection of the tachometric linearity
12. Calibration of the signal conditioner
13. Detection of the characteristic curve of the voltage as a function speed for different values of the mechanical load
14. Detection of the “frequency as a function of speed characteristic curve

**Experimental study of different types of flow measurement devices.**

**Experimental study of different types of temperature measurement devices.**
Course No. ME-406  Power Plants-II (3, 2)

Vapor Power Cycles

Steam Power Plants
The Reciprocating Steam Engines, Criteria of Performance of Steam Engines, Steam Generators; Fire-Tube and Water-Tube Boilers; Water Circulation; The Steam Drum; Super heaters and Repeaters; Once-Through Boilers; Economizers and Air-Preheaters; Fans; The Stack; Steam Generator Control, Measurements of Dryness Fraction of Steam; Calorimeters, Steam Nozzles, Steam Turbines; The Impulse Principle; The Impulse Steam Turbine, Pressure and Velocity Compounded Impulse Principle; The Impulse Steam Turbine, Pressure and Velocity Compounded Impulse Steam Turbines, The Reaction Principle, The Reaction Steam Turbines; Velocity Triangles for Steam Turbines, Steam Condensers; Direct-Contact and Surface Condensers; Dearation; Feed water Heaters, Boiler makeup and Treatment.

Combined Cycle Power Plants

Nuclear Power Plant
Introduction: Power from Nuclear Energy; Structure of an Atom; Nuclear Fusion and Fission; Radioactivity; Decay Rates and Half-Lives; Converting Mass into Energy by Fission, The Chain Reaction, The Reactor; Core; Control Rods; Moderator; Coolant, Thermal-Fission Reactors and Power Plants.

The Source, Use and Management of Energy

Recommended Books:
2. Basic Engineering Thermodynamics, By Rayner Joel. Longman.
EIGHTH

SEMESTER MECHANICAL

ENGINEERING
### SCHEME OF STUDIES FOR EIGHTH SEMESTER B.Sc MECHANICAL ENGINEERING

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<td>Theory</td>
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<td>Automatic Controls</td>
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<td>Industrial Management</td>
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<td>Industrial Health and Safety</td>
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**Total Contact Hours:** 11  12  
**Total Credit Hours:** 11  4  15
Course No. ME-407  
Refrigeration and Air-Conditioning (3, 3)

**Vapor Compression System:**  

**Vapor Absorption System:**  

**Solar Radiations:**  
Direct and diffuse radiations, Earth-sun angles, Heat gain through glass, External shading, Internal shading.

**Heat Transfer Through Building Structures:**  
Fabric heat gain, Overall heat transmission coefficient, Evaluation of heat transfer through walls and roofs using equivalent temperature differential (ETD) method, ventilation, Infiltration.

**Load Calculations and Applied Psychometry**

**Cooling Load:**  
Occupancy load, lighting load, appliances load etc. Product load, process load, heat gain through ducts, leakage etc, Ventilation load, Infiltration load, Grand total load on air-conditioning apparatus, Calculation of state and rate of supply air.

**Heat load**

**Miscellaneous:**  
Chillers, cooling towers, package units, split system, Air-handling units, Ducting, Fans.

**Recommended Books:**
1. Refrigeration and Air-conditioning by C.P. Arora
2. Principles of Refrigeration by Dossat
Course No. ME-407
Refrigeration & Air Conditioning (Practical)

1. Demonstration of the components of vapor compression cycle
2. Demonstration of the following:
   a. Window type Air-Conditioner
   b. Car Air-Conditioner
   c. Refrigerated Water Cooler
   d. House hold refrigerator (both vapor compression and vapor absorption type)
3. Demonstration of tools/equipment used in refrigeration.
4. Demonstration of the following for a vapor compression refrigeration system
   a. Leakage testing
   b. Charging of refrigerant including vaccume production and consequent charging
   c. Ways of determining proper amount of charge.
5. Determine the coefficient of performance of Technovate vapor compression unit both in direct and reverse cycle based on the following:
   a. Carnot cycle
   b. Enthalpies
6. Demonstrate the following on the recirculation Air-conditioning unit along with the associated calculations.
   a. Heating
   b. Cooling
   c. Humidification
   d. Dehumidification
   e. Recirculation
Course No. ME-408
Automatic Controls (3, 3)

**Basic Concepts**

**Mathematical Modeling of Physical System**

**Transfer Functions and Systems Response**

**Stability of control System**
Concept of Stability, Routh Hurwitz Criterion, System stability using Matlab

**Root Locus Methods** and its use in Control System Design, Root Locus using Matlab.

Introduction to PID controllers.

**Industrial Applications**

**Recommended Books:**
1. Automatic Control, by Francis H. Raven
2. Modern Control System, by Richard C. Dorf
3. Automatic Control by J.J. Distofano etal.
4. Modern Control Engineering by Katsushiko Ogata
Course No. ME-408
Automatic Controls (Practical)

1. The study of DC and AC motors: Electrical and mechanical characteristics.
2. One-loop speed control with techogenerator and armature feedback.
3. Zero Adjustment
4. PID controllers
5. Proportional-integrative gain regulation
6. Derivative action regulation
7. Dynamic response of the system
8. Analysis and the use of software from PC in exercise of speed setting/reading
Course No. ME-409  
Industrial Management (3, 0)

Plant Management  

Facilities Planning & Design  

Human Resources Management  

Recommended Books:

3. Production Management by Kieth & Lockyer.
Course No. ME-410
Industrial Health & Safety (2, 0)

- Define workplace health and safety, for a specified industry.
- Identify the role of the workplace health and safety officer in a workplace.
- Explain the operation of consultative processes in the management of workplace health and safety.
- Define duty of care, for a specific industry.
- Explain workplace health and safety regulations within a specified industry.
- List factors that contribute towards safety problems with equipment.
- Develop a procedure for the safe operation of a piece of machinery.
- List factors that contribute towards problems with manual handling, in a specific industry.
- Determine health risks in a specified workplace.
- Determine accident risks in a specified workplace.
- Develop a code of practice to minimize accident risks in a specified workplace.
- Distinguish between different classes of dangerous goods, for a specific industry
- Interpret different standard hand signals used in a specific workplace.
- Interpret different standard signs used in the workplace, including:
  - hazardous chemicals
  - vehicle and pedestrian
  - fire
  - dangerous machinery
  - noise
  - eye protection