FIRST SEMESTER MECHANICAL ENGINEERING

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

No.	Course	Contact Hours		Credit Hours
		Theory	Lab	Total
BSI-101	Islamic Studies	2	0	2
BSI-110	Pakistan Studies	2	0	2
BSI-122	Calculus	3	0	3
EE-109	Electrical Technology	3	3	4
ME-105	Engineering Workshops	0	3	1
ME-107	English Composition & Comprehension	3	0	3
ME-108	Computer Programming Lab	0	6	2
	Total Contact Hours	13	12	
	Total Credit Hours	13	4	17

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.
Muslim Nationalism, Formation of Muslim League, Lucknow Pact.
Nehru Report 1928.

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 1956, The Constitution of 1962
The Constitution of 1973

Natural Resources
Geo-Strategic Importance of Pakistan
Pakistan's Relations with neighboring countries.
The concept of Human Rights.

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:
Basic concepts of multivariate function, Level curves and surfaces, Limits and continuity, Partial differentiation, Geometric interpretation, higher partial derivatives. Tangent planes, Total differential, Vector functions and its differentiation and integration, The directional derivative, The gradient, Scalar and Vector fields, Normal property of the gradient, Divergence, Curl, Tangent planes and normal lines, Extrema of functions of two variables, Second partials test, Extreme value theorem, method of Constrained optimization and Lagrange multipliers.

Recommended Books:

1.   Mathematics for Engineers Second Edition by Robert Davison Wesley.
2.   Multivariate Calculus Second Ed. By Robert T. Smith, Roland B. Minton. McGraw-Hill Higher Education Edition.

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
Timber, Its Defects and Preservation Methods, Different Types of Wood Joints, Brief Introduction to Wood Sawing, Planning, Turning, Mortising and Tensioning Processes. Pattern Making, Pattern Types and Allowances.

Basics of Electric Shop
Types and Uses of Cables, Electrical Accessories for House Wiring and Testing Methods. Type of Wiring Systems, Circuit, Wires Specifications.

Functions of Forge & Foundry Shop
Brief Introduction, Tools and Accessories, Furnace Types, Heat Treatment Furnaces. Molding Sands, Mould Making, Casting, Forging Process and Operation.

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
Fusion Welding Process: Oxy-Fuel Gas Welding, Arc Welding, Electrodes, Thermit Welding and Electron Beam Welding. Solid State Welding Process: Cold Welding, Ultrasonic Welding, Friction Welding, and Resistance Welding. Weld Quality, Weld-ability, Weld Design and Process Selection, Brazing, Soldiering, Adhesive Boding, Joining Plastics

Recommended Books:

1. Workshop Technology Part-1 by W.A.J. Chapman.
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

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SCHEME OF STUDIES FOR SECOND SEMESTER B.Sc MECHANICAL ENGINEERING

		Contact Hours		Credit Hours
No.	**Course**	**Theory**	**Lab**	**Total**
BSI-231	Differential Equations	3	0	3
ME-101	Engineering Statics	3	0	3
ME-102	Fluid Mechanics I	3	0	3
ME-104	Technical Writing & Communication Skills	3	0	3
ME-105	Engineering Drawing & Graphics	2	3	3
EE-119	Digital Logic and Design	3	3	4
	Total Contact Hours	17	6	
	Total Credit Hours	17	2	19

Course No. BSI-231
Differential Equations (3, 0)

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 complicatins. 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:

Basic concepts, Linear and nonlinear p.d. equations, Quasi linear and Quasi nonlinear p.d.equations, Homogeneous and non-homogeneous p.d.equations, Solutions of p.d.equations, Boundary and initial conditions as Dirichlet condition, Neumann condition, Robbins/Mixed condition, Classification of p.d.equations as Elliptic, Parabolic and Hyperbolic.

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
2. Advanced Engineering Mathematics Sixth Ed. By Louis C. Barrett, McGraw Hill International Editions.

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:

1.   Engineering Mechanics (Vols. 1). By J. L. Meriam & L. G. Kraige. John

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
Uniform and Non-Uniform Flow, Steady and Unsteady Flows, Laminar and Turbulent Flow, Path Line, Streamlines, Stream Tubes.

Basic Equations And Their Application
Continuity Equation, Bernoulli's Equation, Flow Through Venturimeter, Flow Through Orifice, Time of Emptying of Tank, Flow Through Nozzle, Pitot Tube, Weirs and Notches, Free and Forced Vortices.

Flow Through Pipes
Major and Minor Losses, Flow Through Mouthpieces, and Power Transmission Through Pipes. Hydraulic Gradient.

Open Channels
Uniform Flow in Open Channels, Chezy Formula. Manning Formula and Darcy Formula. Discharge Through Rectangular, Trapezoidal and Circular Cross-Sections. Most Economical Cross-Section. Hydraulic Gradient and Energy Lines. Hydraulic Jump and its Location.

Recommended Books:

1. Fluid Mechanics, By Victor L. Strecter. McGraw-Hill
2. Fluid Mechanics and Hydraulic Machinery, By K. R. Arora, Standard Publisher, India.

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Course No. ME-104
Technical Writing and Communication Skills (3, 0)

Part One

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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.

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Part Two

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Communication Skills

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

Recommended books:

1   Technical Report Writing Today by Pauley & Riordan, Houshton Miffin Co., USA.
2   Communication Essentials, University of Phoenix, Simon &Schuster Publishing, USA.

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:

1   Engineering Drawing and Graphic Technology 14th Edition by T.E. French, C.J. Vierk and R.J. Foster.
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:

1   Engineering Drawing and Graphic Technology 14th Edition by T.E. French, C.J. Vierk and R.J. Foster.
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

<center>**Course No. EE-119**
Digital Logic Design (Lab)</center>

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.
4. Design & Implementation of XOR & XNOR Gates using NAND Gate.
5. Design & Implementation of Half adder & Half Subtractor.
6. Design & Implementation of Full adder using two half adders & NAND Gates.
7. Design & Implementation of 2-4 decoders.
8. Design & Implementation of 4-1 Multiplexer.
9. Design & Implementation of Full adder using Decoder.
10. Design & Implementation of 4 Bit Adder/ Subtract or.
11. Design & Implementation of Clocked SR Flip Flop.
12. Design & Implementation of JK Flip Flop & Master Slave JK Flip Flop.
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

	Semester 3			
No.	**Course**	**Contact Hours**		**Credit Hours**
		Theory	**Lab**	**Total**
BSI-111	Linear Algebra	3	0	3
ME-201	Engineering Dynamics	3	3	4
ME-202	Fluid Mechanics II	3	3	4
ME-203	Solid Mechanics-I	3	0	3
ME-205	CAD-I Lab	0	6	2
	Total Contact Hours	12	12	
	Total Credit Hours	12	4	16

Course No. BSI-111

Linear Algebra (3, 0)

Vector Algebra:
Introduction to scalars and vectors, Vectors in the plane, Scalar and vector products, Lines in R^2, 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:
Independent, Dependent and Inconsistent system of equations and its graphical representation, Trivial and non-trivial solutions of homogeneous system of linear equations and its applications as linear models in Business, Economics, Science, Electric Circuits and other branches of engineering. Solution of linear system of equations by determinants and its applications as Leontief input-output matrix of the economy, Coding and decoding theory.

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:
1.   Linear Algebra and its Applications, 2nd Edition, David C Lay, Addison-Wesley Publication Jan 1998.

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
Force, Mass and Acceleration, Newton's Second Law of Motion, Equation of Motion, Rectilinear Motion, Curvilinear Motion, Work and Energy, Potential Energy, Impulse and Momentum, Conservation of Momentum.

Recommended Book:

1. Engineering Mechanics (Vols. 2). By J. L. Meriam & L. G. Kraige. John

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
Introduction to Potential Flow Theory, Stream Function, Velocity Potential Function, Rotational and Irrotational Flow, Condition of Orthogonality.

Fluid Dynamics
Steady State Viscous Flow of Incompressible Fluids. Flow, Flow in a Pipe, Viscous Flow Over Flat Plate, Development of boundary Layer Theory. Laminar Boundary Layer, Turbulent Boundary Layer, velocity profile in boundary layer, Drag and Drag coefficient, lift and Lift coefficient.

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
Impact of Jet, Hydraulic Turbines, Pelton Wheel, Francis Turbine, Kaplan Turbine, Draft Tube, Performance of hydraulic Turbine, Specific Speed of Turbine. Reciprocating Pump. Air Vessel and Its Effects on the Performance of Reciprocating Pump. Centrifugal Pump, Hydraulic Press, Hydraulic Crane, Hydraulic Accumulator, Hydraulic Intensifier.

Recommended Books:

1. Introduction to Fluid Mechanics, By Robert W. Fox and Alant T. Donald. John Wiley & Sons.
2. Fluid Mechanics with Engineering Application, By Robert L. Daugherty, Joseph B. Franzini and E. John Finnemore. McGraw-Hill.
3. Hydraulics and Fluid Mechanics, By E. H. Lewitt. Sir Issac Pitamn & Sons.
4. Fluid Power with Application, By Anthony Esposlto.

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.
9. Study of hydraulic bench.
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)

Mechanical Properties of Materials, Elastic Constants and Their Relationships, Tensile, Compressive and Shear Stress and Strain, Compound Bars, Thermal Stresses. Moments of Inertia, Shearing Force and Bending Moment, Pure Bending of Beams, Shear Stresses in Beams, Deflection of Beams. Torsion of Circular Bars, Hollow and Compound Shafts. Strain Energy. Contact Stresses, Thin Walled Cylinders.

Recommended Books:
1. Mechanical of Materials by F. P. Beer & E. R. Johnston.
2. Mechanics of Engineering Materials by P. P. Benham & R. J. Crawford
3. Mechanics of Solids & Strength of Materials by F. V. Warnock
4. Strength of Materials by F. L. Singer.

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.

Plotting a drawing. Plotting from Model Space. Creating Layouts in Paper Space.

Recommended Books:

1.   AutoCAD 2002 User's Guide by *AutoDesk.*
2.   AutoCAD 2002 Command Reference by *AutoDesk.*
3.   Mastering AutoCAD 2002 by *George Omura*

FOURTH SEMESTER MECHANICAL ENGINEERING

SCHEME OF STUDIES FOR FOURTH SEMESTER B.Sc MECHANICAL ENGINEERING

Semester 4				
No.	**Course**	**Contact Hours**		**Credit Hours**
		Theory	**Lab**	**Total**
BSI-242	Numerical Analysis	3	0	3
ME-206	Thermodynamics	3	3	4
ME-204	Solid Mechanics II	3	3	4
ME-207	Engineering Metallurgy	3	3	4
ME-215	Machine Design-I	3	0	3
	Total Contact Hours	15	9	
	Total Credit Hours	15	3	18

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:

1. Numerical Methods for Engineering, Science and Mathematics, 2nd Ed. By Prof. Mumtaz Khan, December 2002.
2. Ordinary & Partial Differential Equations with Numerical Techniques for Engineering, Science and Mathematics, 2nd Ed. By Prof. Mumtaz Khan, April 2004.

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.

Fuels and Combustion: Solid, liquid and gaseous fuels. Combustion equations. Stoichometry. Enthalpy of formation. First law analysis for reacting substances. Internal energy and enthalpy of combustion. Combustion efficiency.

Recommended Books
1. Fundamentals of Classical Thermodynamics by Van Wylen and Sontagg, John Wiley.
2. Fundamentals of Thermodynamics by Moran and Shapiro.

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Course No. ME-204
Solid Mechanics-II (3, 3)

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Plane Stress and Strain, Principal Stresses and Strains, Mohr's Circle for Stress and Strain, Theories of Failure. Yield, Fatigue and Creep. Virtual Work and Associated Energy Theorems. Deflection and Stresses, Thin and Thick Curved Bars, Thin Walled Pressure Vessels, Thick Cylinders.

Recommended Books:
1.   Mechanics of Materials by F. P. Beer, E. R. Johnston
2.   Mechanics of Engineering Materials by P. P. Benham & R. J. Crawford
3.   Strength of Materials (Vol. 1-2), Advanced Theory & Applications by J. Alexander & J. S. Gunasekra.

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

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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.

Engineering Metallurgy (3, 3)

Review of Atomic Structure in Solids

Concept of Crystal Geometry, Atomic Arrangement, BCC, FCC-HCP, Slip Planes, Atomic Density, Micro and Macro Examination of Metals, Non-Destructive Testing of Metals, Solidification of Metals, Crystal Growth. Determination of Temperature of Freezing and Melting.

Metals and Alloy Systems.

Production of Iron, Wrought Iron, Cast Iron. Production of Steel and Its Classification, British Standards and ASTM Standard Specification on Iron/Steel. Metals and Alloys for Special Application.

Alloys and Equilibrium Diagrams

General Alloy Structure. Solid Solutions, Substitute and Interstitial Solid Solution Diagram, Complete and Partial Miscibility In Solid State. Phase Rules, Iron Iron-Carbide System.

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

Lattice Defects, Vacancy, Interstitial, Dislocation and Screw Dislocation, Deformation by Slip and Twining, Role of Dislocation and Grain Size in Controlling the Mechanical Properties, Ultimate Strength, hardening Strain, Toughness, Density. Transition Temperature in Steal.

Recommended Books:
1.   The Science and Engineering of Material, By Donald R. Askeland PWS-Kent Publishing Co.
2.   Physical Metallurgy, By Sidney H. Anver. McGraw-Hill.

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.
3. Preparation and Micro-examination of given specimen, using universal projection microscope.
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)

Introduction to Design. Basic Concepts in Design of Machine Parts: Factor of Safety, Codes and Standards, Role of Economics, Reliability. Fits, Allowances and Tolerances. Design of Threaded Fasteners, Riveted Joints, Keys, Cotters, Pins and Knuckle Joints. Design of Welded Joints. Design of Clutches, Brakes, Flywheels and Couplings. Design of Rolling Element Bearings. Design of Journal Bearings.

Recommended Books:

1. Mechanical Engineering Design, By J. E. Shigley and Mischke. McGaw-Hill.
2. Fundamentals of Machine Component Design, By R.C. Juvinall and K. M. Marshek. John Wiley.
3. Intermediate Engineering Drawing, By A. C. Parkinson. Pitman & Sons.
4. Engineering Drawing and Graphic Technology, By T. E. French, C. J. Vierck, and R. J. Foster, McGraw-Hill Illustrated AutoCAD, BPB Publications, India.

FIFTH SEMESTER MECHANICAL ENGINEERING

SCHEME OF STUDIES FOR FIFTH SEMESTER B.Sc MECHANICAL ENGINEERING

No.	Course	Contact Hours		Credit Hours
		Theory	Lab	Total
ME- 301	Mechanics of Machines & Vibration	3	3	4
ME- 302	Small Business Development & Entrepreneurship	3	0	3
ME- 305	Machine Design-II	3	0	3
ME- 307	Engineering Materials	3	0	3
ME- 309	Engineering Economics	3	0	3
ME- 315	CAD-II Lab	0	6	2
	Total Contact Hours	15	9	
	Total Credit Hours	15	3	18

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Course No. ME-301
Mechanics of Machines & Vibrations (3, 3)

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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
Equation of Motion, Energy Method, Viscously Damped Free Vibration, Logarithmic Decrement, Harmonically Excited Vibration, Forced Harmonic Vibration, Vibration Isolation and Vibration Measuring Instruments.

Two Degree of Freedom System
Normal Modes of Vibration, Coordinated Coupling, Forced Harmonic Vibration, Vibration Absorber, and Vibration Damper.

Recommended Books:

1.   Theory of Machines and Mechanisms, 2nd Edition, By Shigley and Uicker,

2.   published by McGraw Hill Book Company.

3.   Design of Machinery by Norton

4.   Mechanical Vibrations Theory & Applications by W.T. Thomson

5.   Mechanical Vibrations by Schaum's Outline Series

6.   Mechanical Vibrations by S.S. Rao, Addison, Wesley Publishing Company.

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.

ME-302   SMALL BUSINESS DEVELOPMENT & ENTREPRENEURSH1P (3,0)

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:

Entrepreneur and Entrepreneurship, Evolution of the concept of entrepreneur, Characteristics of an entrepreneur, Distinction between an entrepreneur and a Manager, Functions of an entrepreneur, Types of entrepreneur. Entrepreneur. Entrepreneurial Feelings, Entrepreneur background and Characteristics, An Introduction to entrepreneurship, Concepts of entrepreneurship, Growth of entrepreneurship, Role of entrepreneurship in Economic Development, Factors affecting entrepreneurial growth (economic, Non-Economic and Government factors)

The Entrepreneurial Process

Critical factors for stalling a new enterprise. Evaluating opportunities for new enterprise, Ingredients for a successful new business. Self-assessment and feedback, Personal entrepreneurial competencies. Goal setting.

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

identity, Field work started, Marketing issues: Who are your buyers?, Product issues: What are you selling?, Production exercise, Sales and Promotion: How do you sell?. Financial issues: How are you doing?, Targeting and writing the plan: The project. Business Plan compilation exercise.

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

1. Robert D. Hisrich and Michael P. Peter, *Entrepreneurs/lip,* Fifth Edition, Mc Graw Hill
2. S.S. Khanka, *Entrepreneurial Development*
3. Irving Burstiner, *The Small Business Handbook*
4. Bruce A. Kirchhoff, *Entrepreneurship and Dynamic Capitalism*
5. *Modern Business Management, A System & Environment Approach* by Me Graw Hill
6. William D. Bygrave, *The Portable MBA in Entrepreneurs/lip Entrepreneurship* CEFE, Germany, *Development Manual*

Course No. ME-305
Machine Design–II (3, 0)

Design of Belts, Ropes and Chains. Design of Mechanical Springs. Design of Shafts. Kinematics, Force Analysis and Design of Gears. Introduction to Experimental Stress Analysis, Use of Strain gages and Photo Elasticity Methods.

Recommended Books:
1. Mechanical Engineering Design, By J. E. Shigley and Mischke. McGraw-Hill.
2. Fundamentals of Machine Component Design, By R. C. Juvinall and K. M. Marshek. John Wiley.

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

The Decision Making Process, Basic Concepts: Equivalence and compound Interest. Present Worth Analysis, Annual Cash Flow analysis, Rate of Return Analysis, Incremental Analysis. Other Analysis Techniques, Depreciation, Income, Taxes, Replacement Analysis, Inflation and Deflation.

Recommended Books:

1. Engineering Economics Analysis by Donald G Newnan
2. Engineering Economy, Prentice Hall, by Sullivan, James A Bontadelli, DeGarmo
3. Engineering Economy Mc-Grawhill by Anthony J Tarquin and Blank
4. Engineering Economy by White

Composite Materials

Introduction: Particulate-Reinforced Composite Materials, Dispersion Strengthened Composites, True Particulate Composites, Application of Particulate Composites. Fiber Reinforced Composites, Predicting Properties of Fiber-Reinforced Composite, Manufacturing Fibers and Composites, Fiber Reinforced Systems. Laminar Composite Materials and Its Applications, Manufacturing Laminar Composites. Wood, Concrete and Asphalt, Sandwich Structure.

Ceramic Materials

Introduction, Short Range Order in Crystalline Ceramic Materials, Long Range Order in Crystalline Ceramic Materials, Silicate Structure, Imperfection in Crystalline Ceramic Structures, Non-Crystalline Ceramic Materials, Deformation and Failure, Phase Diagrams, Processing of Ceramic, Properties and Applications.

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

Introduction, Chemical Corrosion, The Electro-Chemical Cell, The Electrode Potential in Electro-Chemical Cell, The Corrosion Current in Electro-Chemical Cell, Source of Polarization, Type of Electro-Chemical Corrosion, Protection Against Electro-Chemical Corrosion, Oxidation and Other Gas Reactions, Radiation Damage, Wear and Erosion.

Electronic Materials

Recommended Books:

1. The Science and Engineering of Materials, By Donald R. Askeland PWS-Kent Publishing Co.
2. Physical Metallurgy, By Sidney II. Inver. McGraw-Hill.

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

SCHEME OF STUDIES FOR SIXTH SEMESTER B.Sc MECHANICAL ENGINEERING

		Contact Hours		Credit Hours
Semester 6				
No.	**Course**	**Theory**	**Lab**	**Total**
ME- 310	Ethical & Legal Dimensions of Engineering	2	0	2
ME- 308	Quality Engineering	3	0	3
ME- 306	Power Plants-I	3	3	4
ME- 303	Mechatronics	3	3	4
ME- 304	Manufacturing Processes	3	3	4
	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.

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Course No. ME-308
Quality Engineering (3, 2)

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Quality Fundamentals

Introduction to Quality. Relation between quality and productivity. Sampling production Model, Process Control Model, Quality Assurance Assessment. Total Quality Control. Quality Control Circles, Taguchi's Model. Quality System Standards. I.S.O Quality Models. Quality control and Quality Assurance, Inspection, Quality Audit, Quality Philosophies, Six sigma, Kaizen Techniques.

Inspection & Gauging

Line and End Standards. Linear Measurements; Interferometer, Taylor Theory Of Gauging, Systems of Limits & Fits, B.S. 4500. Angular Measurements; Sine Bar, Angle Gages, Autocollimator. Comparators: Mechanical Electrical, Optical. Surface Texture.

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:

1. Handbook of Industrial Engineering, By G. Salvendy. John Wiley.
2. Metrology for Engineers, By Galyer and Shobolt.
3. Total Quality Control, By A. V. Feignbaum, McGraw-Hill.
4. Statistical Quality Control, By Eugene L. Grant and Richard S. Leavenworth McGraw-Hill Co.

Course No. ME-306
Power Plants-I (3, 3)

Reciprocating Internal Combustion Engines
The Working of IC Engines, Criteria of Performance, Engine Output and Efficiency. Performance characteristics, Factors influencing performance, Real Cycles and the Air-Standard Cycles, Properties of Fuels for IC Engines, Fuel Systems, Supercharging and Turbo Charging, Engine Emissions and Legal Requirements, Alternative Forms of IC Engines, Developments in IC 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
Rot Dynamic Machines for Steam and Gas Turbine Plants; Momentum Principal Applied to Flow Through Rotor, Euler Turbo Machinery Equation, Axial Thrust on the Rotor, Torque Exerted on the Rotor, Overall Efficiency, Stage Efficiency, Reheat Factor, Polytropic Efficiency, Contrifugal Compressors, Radial Flow and Mixed Flow Turbines.

Recommended Books:

1. Applied Thermodynamics for Engineering Technologists, By T.D Eastop and A: Mc Conkey. Longman.
2. Basic Engineering Thermodynamics, By Rayner Joel. Longman.
3. Fundamentals of Classical Thermodynamics, By Gordon J.Van Wylen and Richard E. Sonntag. Wiley International Edition.
4. Engineering Thermodynamics Work & Heat Transfer, by G.F.C Roges and Y.R. Mayhew, Longman.
5. Thermodynamics Applied to Heat Engines,by E.H.Lewitt.Sir Isaac Pitman & Sons.

Course No. ME-306
Power Plants-I (Practical)

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.
9. Experimental study of the performance of a solid-propellant rocket.

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Course No. ME-303
Mechatronics (3, 3)

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Computer Architecture
Microprocessor, Micro-Programming, Bus System. 8085 Microprocessor, Its Internal Architecture and Assembly Language Programming.

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:

1.   Design with Microprocessors for Mechanical Engineers, by A.K. Stiffler, McGraw-Hill.
2.   Microprocessor Architecture, Programming and Applications by Goanikar, Merril Publishing Co.

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Course No. ME-303
Mechatronics (Lab)

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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.
8. Programming for Stack & Subroutines.
9. Programming for interrupts.

Course No. ME-304
Manufacturing Processes (3, 3)

Metal Casting Process & Equipment

Molding and Molding Sand, Classification of Foundry Process, Casting and Its Types, Pattern and Pattern Making. Core and Core Making, Furnace, Crucibles, Molding Tools and Foundry Equipment. Sand Properties, Sand Testing Advantage/Disadvantage of Green/Dry Sand. Die Casting, Casting Defects, Investment Casting

Bulk Deformation Processes
Rolling, Flat Rolling, Rolling Mills, sheet Metal Forming , Shapes Rolling, Production of Seam Less Tubing and Piping. Extrusion and Drawing. Hot and Cold Extrusion, Extrusion and Drawing Equipment, Hydrostatic Extrusion.

(Sheet Metal Forming)
Sheet Metal Characteristics, Formability of Sheet Metals, Bending Sheet and Plate, Tube Bending & Forming, Deep Drawing, Supper Plastic Forming, Explosive Forming Equipment for Sheet Forming.

Machine Processes for Producing Various Shapes
Lathe Machine, Lathe Parts, Lathe Operations, and Lathe Cutting tools, Milling Operation, Milling Machines, Sensitive Drilling Machine, Operation of Planning and Shaping, Gear Manufacturing by Milling, Cutting Fluids, Materials removal, cutting forces, safety measures.

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
2.   Process and Materials of Manufacture by F.A. Lindberg.
3.   Introduction to Manufacturing Process by John Aschey.
4.   Manufacturing Process by B.H. Amstead, P.F. Ostwald.
5.   Manufacturing Technology by M.L Begeman, Hazel Hurst.

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Course No. ME-304
Manufacturing Processes (Practical)

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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

No.	Course	Contact Hours		Credit Hours
		Theory	Lab	Total
ME- 402	Production Automation	3	3	4
ME- 403	Maintenance Engineering	2	0	2
ME- 404	Heat and Mass Transfer	3	3	4
ME- 405	Instrumentation	1	3	2
ME- 406	Power Plants-II	3	0	3
ME- 411	Project	0	6	2
	Total Contact Hours	12	15	
	Total Credit Hours	12	5	17

Table title: **Semester 7**

Course No. ME-402
Production Automation (3, 3)

Automation

Introduction, Economics of Automation, Flow Lines, Mathematical Models, Storage Buffers, Partial Automation, Balancing, Group Technology and Flexible Manufacturing.

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.

Course No. ME-404
Heat and Mass Transfer (3, 3)

Introduction

General Remarks Regarding Difference between Heat Transfer and Thermodynamics, basic Concepts and Modes of heat Transfer, Thermal Conductivity, Coefficient of Convective heat Transfer and its units.

Conduction Heat Transfer - One Dimensional

Steady-State Heat Conduction, Heat Conduction Through a Homogeneous and Composite Plane, Cylindrical and Spherical Walls, Heat Transfer in a Plane Walls in Series or in parallel or in Combination, Electrical Analogs and thermal Circuits for One-Dimensional Internal Heat Source, Combined Conduction and Convention Heat Transfer Introduction to Unsteady-State three-Dimensional with internal Heat Energy Source, General Equation of Conduction.

Convection Heat Transfer

Introduction to Viscous and Non-Viscous Fluid Flows, Continuity, Momentum and Energy Equations of The Laminar Layers on a Flat Plate, Evaluation of Hydrodynamic and Thermal Boundary Layers Thickness and heat Transfer Coefficient, Similarity Parameters in Convention heat Transfer, Reynold's Analogy for Laminar Flow, Introduction to Free and Forced Convention.

Radiation Heat Transfer

Introduction to Radiation, The Concepts of Black Body and Gray Body, Laws of Radiation, Radiation Properties, Radiation Shape Factor, Radiation Exchange between Black and Gray Bodies. Radiation Network, Radiation Exchange Between Infinite Parallel Planes and between Infinite Concentric Cylinders and Spheres, Radiation Shields.

Heat Exchangers

The Overall Heat Transfer Coefficient, Heat Transfer Between Fluids Separated by Cylindrical Walls, Types of Heat Exchangers, The Concept of Mixed and Unmixed Fluids, Correction factor, Fouling Factor, Log Mean Temperature Difference (LMTD), Number of Transfer Units, The heat Exchanger Effectiveness and Design Consideration, Concepts of Minimum and Maximum Fluids.

Mass Transfer

Introduction to Mass Transfer, Fick's Law of Diffusion. Mean Diffusion Coefficient, Schmidt Number.

Recommended Books:

1. Heat Transfer, by J. P. Holman. McGraw-Hill.
2. Basic Heat Transfer, By M. Necati Ozisik. McGraw-Hill.
3. Elements of Heat Transfer, By Frank Kreith. International Text Books Co.
4. Heat Transfer, By Allan J. Chapman. MacMillan.
5. Fluid Dynamics and Heat Transfer, By Knudren and Kats. McGraw-Hill Co.

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)

Significance of Measurement, Planning of Experiments, General Measurement System. Calibration, Static and Dynamic Measurement Sensitivity, Range, Accuracy, Precision. Repeatability, and Uncertainty of Instruments, Sensors and Transducers, Measurement Errors, Instruments for Measurement of Length, Force, Torque, Displacements frequency, Pressure, Flow and Temperature, and motion encoders, Introduction to Data Acquisition Through Computers.

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 a 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

Criteria for the Comparison of Cycles. The Rankine Cycle, Rankine Cycle With Superheat, The Enthalpy-Entropy Chart, The Reheat Cycle, The Regenerative Cycle, Further Considerations of Plant Efficiency Steam For Heating and Process, Use of Economizers and Air-Preheaters, The Binary Vapour Cycle Back-Pressure and Extraction Turbines, Co-Generation (or Combined heat and Power; CHP) and Its Types.

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

General, Combined Cycle with heat-Recovery Boiler. Combined Cycle with Multi Pressure Steam. Steam Cycles for Nuclear Power Plant, Combined Cycle for Nuclear 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

Source of Energy Supply, and Energy Demands, Energy Management and Energy Audits the Technology of Energy Saving. Alternative Energy Sources.

Recommended Books:

1. Applied Thermodynamics for Engineering Technologists, By T. D. Eastop and A. McConkey. Longman.
2. Basic Engineering Thermodynamics, By Rayner Joel. Longman.
3. Thermodynamics Applied to Heat Engines, By E. H. Lewitt, Sir Issac Pitman & Sons.
4. Power Plant Technology, By M. M. El-Wakil. McGraw-Hill International Edition.
5. Steam Turbine Theory and Practice, By W. J. Kearlon. Pitman.

EIGHTH SEMESTER MECHANICAL ENGINEERING

SCHEME OF STUDIES FOR EIGHTH SEMESTER B.Sc MECHANICAL ENGINEERING

No.	Course	Contact Hours		Credit Hours
		Theory	Lab	Total
ME- 407	Refrigeration & Air-Conditioning	3	3	4
ME- 408	Automatic Controls	3	3	4
ME- 409	Industrial Management	3	0	3
ME- 410	Industrial Health and Safety	2	0	2
ME- 411	Project	0	6	2
	Total Contact Hours	11	12	
	Total Credit Hours	11	4	15

Semester 8

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Course No. ME-407
Refrigeration and Air-Conditioning (3, 3)

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Vapor Compression System:
Vapor compression cycle and effects of operating conditions on its C.O.P, Heat pump, Refrigerants, H-S and P-H charts.

Vapor Absorption System:
Simple vapor-absorption system, Common refrigerant-absorbent systems, Actual Vapor-absorption cycle. Psychrometry of Air-conditioning processes, Psychrometric chart, mixing processes, sensible heat, latent heat, humidification, dehumidification, cooling and adiabatic processes on psychometric chart, by-pass factor, apparatus dew point, summer air-conditioning.

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
7. Carryout the performance assessment of the R870 vapor compression refrigeration unit.

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Course No. ME-408
Automatic Controls (3, 3)

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Basic Concepts
System, Control System, Input, Output, Open Loop and Closed-Loop Control Systems. Elements of a General Control System, Examples of Control System.

Mathematical Modeling of Physical System
Grounded Chair Representation, Series-Parallel Laws, Equation of Motion for Spring Mass Damper Systems, Levered System, Rotational System, Thermal Systems and Fluid Systems. Simulation of system using Matlab.

Transfer Functions and Systems Response
Review of Lap Lace Transform, Impulse Step and Ramp Functions, Partial fraction expansion using Matlab, Concept of Transfer Functions of Common Components, Transformation of Mathematical Model using Matlab, Block Diagram Algebra, Simulink, Signal Flow Graphs, Impulse Step, and Ramp Response of First and Second Order Systems, Characterization of Response (Time Constant, Overshoot, Rise Time, Setting Time, Steady State Error, Etc.) Relation System Response to Location of System Poles and Zones. System performance using Matlab, Control system characteristics using Matlab.

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

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Course No. ME-408
Automatic Controls (Practical)

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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

Industrial Management (3, 0)

Plant Management
The Production and Services Systems Inputs and Output, Management Concepts and History. Management System Role & Functions of Management. Factors Affecting Industrial Development, Industrial Development of Pakistan, Organization Structures and Types, Productivity, Basic Concepts, Classification, Measurement and Improvement. Role of Work-Study, Work Measurement and Work Sampling.

Facilities Planning & Design
Product Design, Process Planning; Location and Layout; Computerized Methods. ALDEP, CORELAP and CRAFT. Material Handling. Types to Production, Group Technology, Make or Buy Decisions. Demand Forecasting, useful Forecasting Models, Material Requirement Planning. Capacity Requirement Planning MRP-II. Inventory Models and Just in Time (JIT) Technique, Production Planning, Scheduling Problems and Models, Project Management PERT-CPM, Network Scheduling, Decision Making.

Human Resources Management
Recruitment Process, Job Evaluation, Performance Appraisal, Non Financial & Financial Incentives, Training, Labor Relations and Industrial Safety.

Recommended Books:

1. Operations Management, Prentice Hall by Jay Heizer 6th Edition.
2. Production & Operations Management by Evert E. Adam Jr. and Ronald.
3. Production Management by Kieth & Loekyer.

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:

    o hazardous chemicals

    o vehicle and pedestrian

    o fire

    o dangerous machinery

    o noise

    o eye protection