MECHANICAL ENGINEERING, UEC, UJJAIN.

Syllabus for Four Years Bachelor of Technology Degree Course as per NEP-2020

July-2024

SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
CS-4408	Introduction to RDBMS and ERP	-	0	0	2	0 + 1	70	22

Understand the basic concepts of DBMS along with E-R Diagram, learn different keys, SQL, Relational Algebra, get the knowledge of relational dependencies and can normalize the database by applying various normal forms, compare different types of DBMS with Model and to know about data mining and data warehousing, understand storage structure and organization of file system.

Recommended Books :-

1. Database System Concept, A. Silberschatz, H.F. Korth, Sudersan, McGraw Hill.
2. An introduction to Database System, C.J. Date, Addison-Wesley.
3. Fundamentals of Database system, Elmasri and Navathe, Addison-Wesley.

Suggested List of Experiments :-

(1) Display the alternate row from table.
(2) Delete alternate row from table.
(3) Update multiple rows in using single update statement.
(4) Find the third highest paid and third lowest paid salary.
(5) Display the 3rd, 4th, 9th rows from table.
(6) Display the name, which is start with j, k, l or m.
(7) Show all employees who were hired the first half of the month.
(8) Display three records in the first row and two records in the second row and one record in the third row in a single SQL statement.
(9) Write a SQL statement for rollback commit and save points.
(10) Write a PL/SQL for select, insert, update and delete statements.

Course Outcomes (CO's)

After completion of this course the student should be able to :

Course Outcome #	Statement
CO1	Understand the basic concepts of DBMS along with E-R Diagram.
CO2	Learn different keys, SQL, Relational Algebra.
CO3	Get the knowledge of Relational Dependencies and can Normalize the database by applying various normal forms.
CO4	Compare different types of DBMS with Model and to know about Data Mining and Data Warehousing.
CO5	Understand Storage Structure and Organization of file system.

Maping of Courses Outcomes (CO's)with Program Outcomes (PO's) and Programe Specific Outcomes (PSO's) :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO1
CO1	-	3	3	3	3	1	1	-	2	3	3	3	1	1
CO2	2	-	3	3	3	1	1	-	3	3	3	3	1	2
CO3	2	2	2	3	3	2	1	-	3	3	3	3	1	1
CO4	-	2	2	3	3	-	-	-	2	1	2	3	1	1
CO5	-	-	-	2	3	-	-	-	2	1	2	3	1	1
1 – Low, 2 – Moderate, 3 - High														

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

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SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
HS-4406	Industrial Engineering	3 Hours	3	0	0	3 + 0	70	22

UNIT - I :

Introduction : Concept of industrial engineering, techniques of I.E., important applications of I.E. productivity, concept of productivity, importance of productivity, factors affecting productivity, basic work content of a job, various techniques to minimize ineffective work and inefficient time added to a job measurement of productivity, productivity of indirect labor.

UNIT - II :

Work study : Introduction and concept of work study, work study and management, work study and productivity.

Method Study : Definition and concept, scope and objective of method study, criteria of selection of a job for method study, various charts used for method study, critical examination.

UNIT - III :

Work Measurement : Introduction, scope and objectives of work measurement, procedure of work measurement, time study, basic procedure of time study, advantages and limitations of time Study, various time elements considered in time study, estimation of number of cycles to be timed. Performance rating, methods of performance rating, various allowances considered in time study. Estimation of standard time, memo-motion and micromotion study, Therbligs, work sampling, PMTS, work factor.

UNIT - IV :

Wages and Incentives: Introduction, definition, factors influencing wages, minimum guaranteed wages to employees, characteristics of a satisfactory wages system, time wages system, concept of wage incentives, causes for failure of incentives plans, workers attitude towards incentive. Halsay's premium plan, Emerson's efficiency plan, Tailor's differential piece rate system, Merrick's multiple piece rate system.

Cost Estimation: Meaning, objectives, functions, constituents of costs, cost structure, fixed and variable costs, semi variable cost, Break-even analysis, direct and indirect costs, overheads. Using standards in estimating, role of industrial engineering in estimating costs, activity based costing.

UNIT - V :

Ergonomics and Human Factor Engineering : Introduction, objectives and scope of ergonomics, introduction to information theory, human sensory system, relative capabilities of human beings and machines displays, visual displays, qualitative and quantitative type of displays, human motor activities, bio-mechanisms of motion, energy expenditure in physical activities, human input and output channels, anthropometry, anthropometric data and their uses, work – space dimensions, design of seat and seating arrangements, location of components, design of work place.

Recommended Books :-

1. Introduction to work study by George Kanawaty; ILO.
2. Time and Motion Study by R.M Barnes, Wiley Publications.
3. Industrial Engineering and Operation Management by M. Mahajan; Dhanpat Rai Publications.
4. Work study by S. Dalela; Standard Publishers.
5. Work study and Ergonomics by H.S. Shan; Dhanpat Rai Publications.
6. Industrial Engineering and Management by Ravishankar; Galgotia Publications.

Suggested List of Experiments :-

(1) To compare time taken for the assembly of bolt, washer & nut in the present and ssimpsroved methods.
(2) To find out time required to fill two boards with the use of both the hands simultaneously under various conditions.
(3) To construct flow diagram to propose improvement in layout.
(4) To perform method study and prepare two-handed process chart.
(5) Rating practice by actual dealing cards.
(6) Rating practice by actual walking.
(7) To develop the students' practical experience in work sampling.
(8) To find the time required to fill one board with the pins under the various conditions.
(9) To study the changes in heart beat rate for different subjects using Treadmill

Course Outcomes (CO's)

After completion of this course the student should be able to :

Course Outcome #	Statement
CO1	Understand Productivity, its measurement and Basic work content.
CO2	Understand work study and apply method study to improve productivity.
CO3	Analyze work measurement techniques and calculate standard time of an activity.
CO4	Calculate wages, incentives and bonus plans for different organizations & understand cost estimation.
CO5	Design the work place ergonomically and understand anthropometry with respect to industrial environment.

Maping of Courses Outcomes (CO's)with Program Outcomes (PO's) and Programe Specific Outcomes (PSO's) :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO1
CO1	2	2	1	-	-	-	2	1	2	-	2	2	-	3
CO2	3	3	2	2	-	-	-	2	2	-	-	2	-	3
CO3	3	3	2	-	-	-	-	2	2	-	-	2	-	2
CO4	-	2	-	2	-	2	-	2	2	-	2	3	-	1
CO5	2	3	3	2	-	2	-	3	1	-	2	2	2	2
1 – Low, 2 – Moderate, 3 - High														

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SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
ME-4401	Applied Thermal Engineering	3 Hours	3	1	2	4 + 1	70	22

UNIT - I :

Steam Generators : Classification, high-pressure boilers; Lamont, Benson, Loeffler and Velox, performance and rating of boilers, combustion in boilers, heat balance sheet of boilers, super critical boilers, boiler draught.

UNIT - II :

Vapour Power Cycles : Simple steam power cycle, Rankine cycle, Carnot vapour cycle and its limitations, comparison of Rankine and Carnot cycle, effect of boiler and condenser pressure and temperatures on efficiency of Rankine cycle, modified Rankine cycle, reheat cycle, ideal and actual regenerative cycle, feed water heaters, regenerative-reheat cycle, characteristics of ideal working fluid in vapour power cycle, binary vapour cycle, work done and efficiency calculations.

UNIT - III :

Air Compressors : Classification of air compressors, construction and working of various compressors : reciprocating compressor, screw and vane compressor, centrifugal compressor, axial compressor.

Reciprocating Compressor : Ideal and actual indicator diagram, work done for single and multi stage compressor with and without clearance volume, efficiency of compressor: isentropic, isothermal, mechanical and volumetric efficiency; condition for minimum work done in multi stage compression.

UNIT - IV :

Steam Condensers : Introduction, Types of condensers, comparison between jet and surface condenser, effect of back pressure and air leakage on performance of condensers.

Cooling Towers : Types of cooling towers and design of cooling towers.

Theory of Jet propulsion : Introduction to pulse jet and ram jet engines.

UNIT - V :

Gas Dynamics: Velocity of pressure pulse in a fluid, speed of sound, Mach number (M), Mach cone, stagnation properties, one-dimensional steady isentropic flow, Ratio of areas as a function of Mach number, mass flow rate and critical pressure ratio, Normal shock.

Steam Nozzles: Types of nozzles, steady flow energy equation and momentum equation applied in steam nozzles, nozzle efficiency, isentropic and adiabatic flow of steam through nozzles, mass of discharge and condition for maximum discharge (choked flow), super-saturated flow.

Recommended Books :-

1. Thermodynamics by Gordon J. Van Wylen; Wiley and Sons Inc.
2. Thermodynamics and Heat Engines by R. Yadav; Central Publishing House.
3. Heat Engines by Pandya and Shah; Charotar Books Distributors.
4. An Introduction to Energy Conversion – Vol II. Energy conversion cycles by V. Kadambi and Manohar Prasad; New Age International (P) Ltd.
5. Steam and Gas Turbines by R. Yadav; Central Pub. House.
6. Gas Dynamics by E. Rathakrishan; Prentice-Hall of India.
7. Compressible Fluid Flow by E. Rathakrishan; Prentice-Hall of India.

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

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Suggested List of Experiments :-

(1) To Study Construction feature of high pressure La Mont Boiler.
(2) To Study construction feature of high pressure Benson Boiler.
(3) To Study Construction feature of high pressure Loeffler Boiler.
(4) To Study construction feature of high pressure Velox Boiler.
(5) To Study the 2-stage reciprocating air compressor using test rig.
(6) To Study different types of Surface condensers.
(7) To Study different types of Jet condensers.
(8) To Study different types of Nozzles.

Course Outcomes (CO's)

After completion of this course the student should be able to :

Course Outcome #	Statement
CO1	Familiarize with the fundamental understanding of working of high pressure boilers and to analyze performance and its modification parameters.
CO2	Apply vapour power cycles in thermal power stations.
CO3	Classify different types of compressors and evaluate work done and efficiencies.
CO4	Evaluate performance parameters of condensers, cooling towers and heat exchangers.
CO5	Understand compressible fluid flow and apply it in steam nozzles.

Maping of Courses Outcomes (CO's)with Program Outcomes (PO's) and Programe Specific Outcomes (PSO's) :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO1
CO1	3	2	3	1	-	1	1	-	-	-	-	1	3	2
CO2	3	3	2	-	-	1	1	-	-	-	-	1	3	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1	3	2
CO4	3	3	3	1	-	-	1	-	-	-	-	1	3	2
CO5	3	3	3	1	-	-	1	-	-	-	-	1	3	2
1 – Low, 2 – Moderate, 3 - High														

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SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
ME-4402	Fluid Mechanics	3 Hours	3	1	2	4 + 1	70	22

UNIT - I :

Properties of Fluid : Pressure, density, specific weight, surface tension, capillarity, bulk modulus of elasticity, vapour pressure, viscosity, Newton's law of viscosity.

Fluid Statics: Pressure at a point, pressure variation in static fluid, manometers, forces on plane and curved surfaces, buoyant force, stability of floating and submerged bodies, relative equilibrium.

UNIT - II :

Fluid Kinetics : Types of flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one and three-dimensional flow, velocity and acceleration of fluid particle, velocity potential, stream function, rotational flow, circulation, flownets, utility and method of drawing flownets, free and forced vortex flow.

Ideal Fluid Flow Theory: Introduction to 2 D flow, source, sink and doublet, flow past cylinder.

UNIT - III :

Fluid Dynamics : Euler's equation, Euler’s equation of motion along a streamline, Bernoulli’s equation, engineering applications of Bernoulli’s equation, Venturimeter, orificemeter, nozzlemeter, rotameter, pitot static probe, current meters, notches and weirs, linear momentum equation for steady flow and its applications, forces on pipe bends, moment of momentum equation and its applications, forces on fixed and moving vanes, momentum correction factor, energy correction factor.

UNIT - IV :

Flow through Pipes: Introduction to laminar and turbulent flow, Reynolds experiment, Critical Reynold's number, relation between shear stress and pressure gradient, laminar flow through circular pipes, Hagen-Poiseuille's equation, laminar flow between parallel plates, velocity distribution in pipes, friction factor, Moody's chart, hydraulic gradient line and total energy line, minor head losses in pipes, pipe networking, transmission of power through pipe.

Boundary Layer Theory: Development of boundary layer, displacement, energy and momentum thickness.

UNIT - V :

Dimensional Analysis: Dimensional analysis, dimensional homogeneity, Rayleigh's method, Buckingham's Pi theorem, physical significance of various dimensionless numbers, similarity laws, model testing and its applications.

Flow over Immersed Bodies: Streamline and bluff bodies, lift and drag coefficients, flow over circular cylinder and aerofoils.

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

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Recommended Books :-

1. Fluid Mechanics by Som and Biswas; Tata McGraw Hill.
2. Fluid Mechanics by Cengel; McGraw Hill Education.
3. Fluid Mechanics by Modi and Seth; Standard Book House.
4. Fluid Mechanics by Massey; Taylor and Francis.
5. Fluid Mechanics by D.S. Kumar; S.K.Kataria and Sons.

Suggested List of Experiments :-

(1) Pressure measurement by different types of manometers.
(2) Determination of metacentric height of a floating body.
(3) Verification of the Bernoulli's theorem.
(4) Calibration of Venturimeter.
(5) Determination of the coefficient of discharge of orifice-meter.
(6) Flow velocity measurement by Pitot tube.
(7) Verification of impulse-momentum principle.
(8) To determine the friction factor for the pipes (Major Losses).
(9) To determine the minor losses due to sudden enlargement, sudden contraction and bend.
(10) To determine the coefficient of discharge of Notch (V, Rectangular and Trapezoidal types).
(11) To study rotating mass of fluid in free & forced-vortex condition.

Course Outcomes (CO's)

After completion of this course the student should be able to :

Course Outcome #	Statement
CO1	Explain various properties of fluid and analyze the behavior of fluid at rest.
CO2	Explain the kinematics of fluid element and establish the condition of irrotationality. Describe the flow net and pressure distribution for simple ideal flow.
CO3	Apply conservation equations in solving fluid engineering problems.
CO4	Estimate major and minor losses in flow through pipes. Explain development of boundary layer.
CO5	Apply the principles of similitude and dimension analysis to model studies. Describe the variation of lift and drag coefficient with the variation in flow.

Maping of Courses Outcomes (CO's)with Program Outcomes (PO's) and Programe Specific Outcomes (PSO's) :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO1
CO1	3	3	1	-	-	-	-	-	1	-	-	1	2	1
CO2	3	3	2	1	-	-	-	-	1	-	-	1	2	-
CO3	3	3	3	2	-	-	-	-	1	-	-	1	3	2
CO4	3	3	3	1	-	-	-	-	1	-	-	1	3	2
CO5	3	3	3	2	-	-	-	-	1	-	-	1	3	2
1 – Low, 2 – Moderate, 3 - High														

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SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
ME-4403	Strength of Materials	3 Hours	3	1	2	4 + 1	70	22

UNIT - I :

Simple Stress and Strains : Introduction, mechanical properties of materials, stress, strain, elastic limit, Hooke's law, analysis of a tapered bar and rod, composite bar, shear stress, shear strain, elastic constants, relationship between elastic constants, thermal stress, strain.

Strain energy: Concepts and problems.

UNIT - II :

Principal Stresses and Strains : Introduction, principal planes, principal stresses and principal strains, methods of determination of stresses in oblique section, analytical and graphical methods for determine the stresses on oblique plane, Mohr's circle.

UNIT - III :

Stresses in Beam : Simple and pure bending, theory of bending, bending equation, flexural rigidity, bending stresses in beam, section modulus for various shapes of beam section, composite beam, strength of beam, shear stresses in beam, shear stress distribution in different section.

UNIT - IV :

Deflection of Beams: Relation between slope, deflection and radius of curvature, double integration method, Macaulay method, moment area method, Castigliano's theorem, Maxwell reciprocal theorem.

UNIT - V :

Torsion of Shafts: Introduction, shear stress, circular shaft, torsion formula, torsional rigidity, hollow, stepped and composite shafts, Helical spring.

Columns: Euler's theory, classification of columns, equivalent length, limitation of Euler's formula. Rankine's formula, Johnson's parabolic formula, Straight line formula.

Recommended Books :-

1. Strength of Materials by Ryder; Palgrave McMillan.
2. Strength of Materials by Gere and Timoshenko; PWS Publishing Company.
3. Strength of Materials by S.S. Rattan; Tata McGraw Education.
4. Strength of Materials by R.K. Bansal; S. Chand Publisher.

Suggested List of Experiments :-

(1) Study of Universal Testing Machine.
(2) To perform tensile test of mild steel and to draw stress-strain curve.
(3) To determine the compressive strength of wooden specimen (1) along the grains, (2) across the grains.
(4) To find the values of bending stresses and young's modulus of the material of a beam through U.T.M.
(5) To study the Impact Testing Machine and Perform Izod Impact Test.

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

Contd. … 2

(6) To study the Impact Testing Machine and Perform Charpy Impact Test.
(7) To determine the Hardness of the given Specimen using Rockwell hardness testing machine.
(8) To determine the hardness of the given specimen using Brinell hardness test.
(9) To demonstrate how fatigue tests are conducted in fatigue testing machine for testing specimens subjected to cyclic (fatigue) loadings.
(10) To conduct torsion test on mild steel or cast iron specimens to find out modulus of rigidity.

Course Outcomes (CO's)

After completion of this course the student should be able to :

Course Outcome #	Statement
CO1	Understand the concept of stress and strain and calculate stress and deformation in members of different cross-sections.
CO2	Evaluate principle stresses by applying analytical and graphical methods.
CO3	Solve problems determining shearing stresses in beams of different cross-sections.
CO4	Calculate slope and deflection in beams by using different methods.
CO5	Analyze and design shafts and springs and cylinder.

Maping of Courses Outcomes (CO's)with Program Outcomes (PO's) and Programe Specific Outcomes (PSO's) :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO1
CO1	3	3	1	-	-	-	-	-	1	-	-	1	1	2
CO2	3	3	2	1	-	-	-	-	1	-	-	1	-	-
CO3	3	3	3	2	-	-	-	-	1	-	-	1	-	1
CO4	3	3	3	1	-	-	-	-	1	-	-	1	1	2
CO5	3	3	3	2	-	-	-	-	1	-	-	1	-	2
1 – Low, 2 – Moderate, 3 - High														

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SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
ME-4404	Manufacturing Process	3 Hours	4	0	2	4 + 1	70	22

UNIT - I :

Metrology : Standards of measurements, linear and angular instruments; slip gauges, comparators, sine bar, angle gauges, clinometers, tape gauge, screw thread measurements.

UNIT - II :

Pattern Making : Pattern and pattern making, pattern allowances, types of patterns, pattern design considerations, core, core boxes, Design of Gating systems.

Foundry: Molding and core sands and their properties, moulding machines, centrifugal casting, die casting shell moulding, cupola description and operation, lost wax moulding, continuous casting.

UNIT - III :

Forging and Rolling : Theory and application of forging processes, principle of drop and horizontal forging machines, optimum forging temperature.

Rolling Mechanisms : General description of machines and process, rolling of structural sections plates and sheets, hot and cold rolling technique.

Extrusion: Introduction, backward, forward impact and hydrostatic extrusion, forming and electro hydraulic forming.

UNIT - IV :

Press Working : Description and operation of processes, process of shearing, bending, forging and drawing press, tool dies, auxiliary equipment, safety devices, stock feeders, scrap cutters, requirements of stock material, type of press dies.

UNIT - V :

Welding : Gas welding, electric arc welding, A.C. and D.C. welding machines and their characteristics, flux and electrodes, electric resistance welding processes, solid state welding, fusion welding processes, thermit, TIG and MIG welding, atomic hydrogen welding, soldering and brazing, gas cutting.

Spinning : Introduction to spinning, type of spinning.

Suggested List of Experiments :-

(1) To make a Fillet-joint, using given mild steel piece by arc welding.
(2) To make a Butt Joint of mild steel piece by using gas welding.
(3) To study and observe resistance welding (spot welding).
(4) To study and observe various stages of casting through demonstration of Sand Casting Process.
(5) To Design and Manufacture a Wooden Pattern for a given Casting.
(6) To prepare a sand mould, using single split piece pattern.
(7) To make mould for single piece pattern.
(8) To study vacuum forming machine for creating Mould ***(IIT, Indore collaborated Maker Space Lab)***.
(9) To study slide mitre saw machine ***(IIT Indore collaborated Maker Space Lab)***.
(10) To study Makita bend saw machine ***(IIT Indore collaborated Maker Space Lab)***.
(11) To study of Bench grinder, Planer machine, Angle & straight grinder, Marble saw machine, Jig saw wood cutter, cut-off saw machine. ***(IIT, Indore collaborated Maker Space Lab)***.

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Recommended Books :-

1. Workshop Technology by Chapman; Taylor and Francis.
2. Manufacturing Process by Begeman; John Wiley.
3. Manufacturing Engineering and Technology by Kalpakjian and Schmid; Pearson Education.
4. Manufacturing Science by Ghosh and Mallik; East-West Press.
5. Workshop Technology (Vol. I) by B.S. Raghuwanshi; Dhanpat Rai and Company.
6. Elements of Workshop Technology (Vol.I) by Hajra Choudhury; Media Promoters and Publishers.

Course Outcomes (CO's)

After completion of this course the student should be able to :

Course Outcome #	Statement
CO1	Understand the principle of metrology and familiarize with the working of measuring instruments.
CO2	Classify different types of pattern and allowances and explain various casting processes.
CO3	Understand the principle of metal forming and recognize different forming processes to shape materials.
CO4	Describe the working principle of press and classify various die operations.
CO5	Understand the principle of joining process and describe different welding processes.

Maping of Courses Outcomes (CO's)with Program Outcomes (PO's) and Programe Specific Outcomes (PSO's) :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO1
CO1	3	2	1	-	-	-	-	-	1	-	-	1	-	2
CO2	3	2	2	-	-	-	-	-	1	-	-	1	-	3
CO3	3	2	1	-	-	-	-	-	1	-	-	1	-	3
CO4	3	-	-	-	-	1	-	-	1	-	-	1	-	2
CO5	3	1	-	1	-	-	-	-	1	-	-	1	-	3
1 – Low, 2 – Moderate, 3 - High														

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

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