6th Semester

Basaveshwar Engineering College (Autonomous), Department of Mechanical Engineering

Scheme Autonomous Syllabus (175 credits) 2020-21 (Regular) and 2021-22(Lateral) Batch

VI Sem. B. E (Mechanical Engineering) 2020-21

Sl. No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
01	UME 622C	Mechanical Vibrations	3	2	2	-	50	50	100
02	UME 623C	Heat Transfer	3	2	2	-	50	50	100
03	UME 640 C	Engineering Economics and Financial Accounting	3	3	-	-	50	50	100
04	UME 641 C	Project Management	3	3	-	-	50	50	100
05	UHS 003N	Career Planning & Professional Skills	1	-	2	-	50	50	100
06	UME 6XXN	Open Elective-II *	3	3	-	-	50	50	100
07	UME 604H	Operation Research	3	2	2	-	50	50	100
08	UME 606 L	HMT Lab	1	-	-	2	50	50	100
09	UME 608 L	Dynamics Lab	1	-	-	2	50	50	100
10	UME 609 L	Industrial Automation Lab	1	-	-	2	50	50	100
11	UME 623P	Mini Project	2	-	-	4	50	50	100
Total Credits			**24**	**15**	**08**	**10**	**550**	**550**	**1100**

*****Open elective - II is offered by other department to Mechanical Engineering Students

Note: Online course: (NPTEL / SWAYAM / COURSERA)

1. The course should be of minimum 04 weeks duration to earn 01 credit.
2. The Students has to qualify in MOOCs recommended course of total 03 credits during III/IV/V/VI semester and to be evaluated in VII Semester

Internship : For awarding B.E. (Mechanical Engineering) degree, each student is required to complete minimum of 04 weeks or (02 weeks + 02 weeks) of Internship between 4thand 6th semester to earn 02 credits which will be awarded during 7th Semester.

B. E. MECHANICAL ENGINEERING SEMESTER – VI			
MECHANICAL VIBRATIONS			
Course Code	**UME 622 C**	**CIE MARKS**	**: 50**
Teaching Hours/Week (L:T:P)	3:0:0	**SEE MARKS**	**: 100**
Credits	3	**SEE Exam Hours**	**: 3 Hrs**

UNIT - I

Introduction: **03 Hours**

Types of vibrations, Simple Harmonic Motion (S.H.M), principle of super position applied to Simple Harmonic Motions. Beat's phenomena.

UNDAMPED FREE VIBRATIONS: 07 Hours

Single degree of freedom systems. Undamped free vibration-natural frequency of free vibration, stiffness of spring elements, effect of mass of spring, Compound Pendulum, Determination of natural frequency using Newton's law and energy method.

UNIT - II

DAMPED FREE VIBRATIONS: 05 Hours

Single degree freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping, critical and over damping, Logarithmic decrement.

FORCED VIBRATION: 06 Hours

Single degree freedom systems, steady state solution with viscous damping due to harmonic force. Reciprocating and rotating unbalance, vibration isolation transmissibility ratio due to harmonic excitation and support motion.

UNIT - III

VIBRATION MEASURING INSTRUMENTS & WHIRLING OF SHAFTS: 05 Hours

Vibrometer meter and accelerometer. Whirling of shafts with and without air damping. Discussion of speeds above and below critical speeds.

SYSTEMS WITH TWO DEGREES OF FREEDOM: 05 Hours

Introduction, principle modes and Normal modes of vibration, co-ordinate coupling, generalized and principal co-ordinates,.

Applications: a) Vehicle suspension. b) Dynamic vibration absorber.

UNIT - IV

NUMERICAL METHODS FOR MULTI DEGREE FREEDOM SYSTEMS: 06 Hours

Introduction, Influence coefficients, Maxwell reciprocal theorem, Reyleigh's method, Dunkerley's equation. Stodola method, Method of matrix iteration - Method of determination of the fundamental natural frequency,. Holzer's method.

Introduction to Noise, Vibration, Harshness (NVH) and control: 02 Hours

Subjective response of sound: Frequency and sound dependent human response; the decibel scale; relationship between, sound pressure level (SPL), sound power level and sound intensity scale; auditory effects of noise; hazardous noise.

Assignment: A set of questions covering whole syllabus will be given to the students. The students will answer to all the questions in the assignment booklet and submit.

Course outcomes: By the end of course with aid of design data handbook students shall be able to,

- **CO1** Understand the fundamentals, causes and the need of mechanical vibrations and mathematical models for undammed single degree of freedom systems.
- **CO2** Analyze the mechanical model of damped free and forced vibratory system and formulating mathematical models for different damping systems.
- **CO3** Analyze and discus on different vibration measuring instruments. Ability to understand and formulate mathematical models for two degree of freedom systems of theoretical and real life engineering systems.
- **CO4** Analyze and formulate mathematical models for several degree of freedom systems using different numerical techniques. Able to understand causes and effects of Noise, Vibration, Harshness (NVH) and control.

Question paper pattern

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the publisher	Edition and year
Textbook/s				
1	Mechanical Vibrations	G. K. Grover	Nem Chand & Bros	8th Edition 2009
2	Mechanical Vibrations	V.P. Singh	Dhanpat Rai & Company Pvt. Ltd	3rd Edition 2006
Reference Books				
1	Mechanical Vibrations	S.S. Rao	Pearson Education Inc.	4th Edition, 2003.
2	Mechanical Vibrations	S. Graham Kelly	S. Graham Kelly, Schaum's Outline Series, Tata McGraw Hill	Special Indian edition, 2007.
3	Elements of Vibrations Analysis	Leonanrd Meirovitch	Tata McGraw Hill	Special Indian edition, 2007.
4	Mechanical Vibrations	J.B.K Das	Sapna Book House - Bangalore	Edition 2008

B.E. MECHANICAL ENGINEERING SEMESTER – VI			
HEAT TRANSFER			
Course Code	**UME 623 C**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P)	**2:2:0**	**SEE Marks**	**100**
Credits(L: T: P)	**03 (2:1:0)**	**SEE Exam Hours**	**03**

UNIT - I

INTRODUCTION: 03 Hours

Modes of heat transfer, Basic laws governing conduction, convection, and radiation heat transfer,Combined heat transfer mechanism, Overall heat transfer coefficient, Boundary conditions of 1st, 2nd and 3rd Kind. Mathematical formulation of heat conduction problems.

CONDUCTION: 02 Hours

Derivation of general three-dimensional heat conduction equation in Cartesian coordinate system, Special cases, 3-D conduction equation in cylindrical and spherical coordinate systems (No derivation).

ONE DIMENSIONAL CONDUCTION: 05Hours Derivation for heat flow and temperature distribution in a plane wall, Hollow cylinder and hollow sphere without heat generation, Thermal resistance concept & its importance. Composite wall, cylinder and sphere, Contact resistance, Critical thickness of insulation without heat generation, Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, Tip insulated fin and fin with heat transfer from the tip, Fin efficiency and effectiveness, Numerical problems on above topics.

UNIT - II

ONE-DIMENSIONAL TRANSIENT CONDUCTION: 02 Hours

Conduction in solids with negligible internal temperature gradient (Lumped system analysis), Use of Transient temperature charts (Heisler's charts) for slab, long cylinder and sphere, Numerical Problems.

CONCEPTS AND BASIC RELATIONS IN BOUNDARY LAYERS: 04 Hours

Flow over a body, Velocity and thermal boundary layer,Critical Reynolds number,General expressions for drag coefficient and drag force,General expression for local heat transfer coefficient, Average heat transfer coefficient, Nusselt number, Flow inside a duct- velocity boundary layer, Hydrodynamic entrance length and hydro dynamically developed flow, Numerical problems based on empirical relations given in the data handbook.

FREE OR NATURAL CONVECTION: 04 Hours

Application of dimensional analysis for free convection, Physical significance of Grashoff number, Use of correlations of free convection for vertical, horizontal and inclined flat plates, Vertical and horizontal cylinders and spheres, Numerical problemsbased on empirical relations given in the data handbook.

UNIT - III

FORCED CONVECTION: 05 Hours

Application of dimensional analysis for forced convection, Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers, Use of various correlations for hydro dynamically and thermally developed flow inside a duct, Use of correlations for flow over a flat plate, cylinder and sphere. Numerical problemsbased on empirical relations given in the data handbook.

HEAT EXCHANGERS: 05 Hours

Classification of heat exchangers, Overall heat transfer coefficient, Fouling and fouling factor, LMTD analysis of heat exchangers, Effectiveness-NTU methods of analysis of heat exchangers. Numerical problemsbased on empirical relations given in the data handbook.

UNIT - IV

RADIATION HEAT TRANSFER: 06 Hours

Thermal radiation, Definitions of various terms used in radiation heat transfer, Stefan-Boltzmann law, Kirchhoff's law, Planck's law and Wien's displacement law. Radiation heat exchange between two parallel infinite black surfaces, Configuration factor or view factor, Intensity of radiation and solid angle; Lambert's law, Radiation heat exchange between two parallel infinite gray surfaces,Effect of radiation shield (only discussion on nonblack surfaces), Numerical problemsbased on empirical relations given in the data handbook.

CONDENSATION AND BOILING: 04 Hours

Types of condensation (discussion only), Nusselt theory for laminar condensation on a vertical flat surface (no derivation), Use of correlations for condensation on vertical flat surfaces, Horizontal tube and horizontal tube banks, Reynolds number for condensate flow, Regimes of pool boiling, Pool boiling correlations, Numerical problemsbased on empirical relations given in the data handbook.

Assignment: As decided by the Course Instructor

Course Outcomes: At the end of the course student will be able to

- **CO1** *Apply* the knowledge of heat transfer to *analyze* unidirectional conduction heat transfer problems.
- **CO2** *Apply* the knowledge of transient heat transfer to *analyze* time dependent heat transfer problems and fluid flow fundamentals to natural and forced convection heat transfer problems.
- **CO3** *Apply* the knowledge of heat transfer fundamentals to *analyze* forced convection and heat exchanger problems.
- **CO4** *Apply* the knowledge of heat transfer fundamentals to *analyze* radiation and phase change heat transfer problems.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 subdivisions.
- Any five full questions are to be solved choosing at least one from each unit

Sl No	Title of the Book	Name of the Author(S)	Name of the Publishers	Edition and Year
Textbook(S)				
1	Heat Transfer– A Basic approach	M. Necati Ozisik	Tata Mc Graw Hill	International ed. 1998
2	Heat Transfer – A Practical approach	Yunus A. Cenegal	Tata Mc Graw Hill	2002
Reference Books				
1	Heat Transfer	J.P.Holman	Tata Mc Graw Hill	9th edition, 2008
2	Principles of Heat Transfer	Kreith	Thomson learning	2001
3	Fundamentals of Heat and Mass transfer	Frank P. Incropera and David P. Dewitt	John Wiley and Sons	4th ed. 1995

4	Heat transfer	P.K. Nag	Tata Mc Graw Hill	2002

Heat and Mass Transfer data handbook:
C.P. Kothandaraman and S. Subramanya, New Age International Publishers, 9th Ed. 2018

B. E. MECHANICAL ENGINEERING Semester - V			
ENGINEERING ECONOMICS			
Course Code	**UME640C**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:2:0**	**SEE Marks**	**100**
Credits	**3**	**SEE Exam Hours**	**03**

UNIT-I

Introduction: 5 Hours

Engineering and Economics, Definition, Engineering Decision-Makers, Problem solving and Decision making, Law of demand and supply, Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Exercises and Discussion.

Present Worth Comparisons: 5 Hours

Conditions for present worth comparisons, Basic Present worth comparisons, Present worth equivalence, Net Present worth, Assets with unequal lives, infinite lives, Future worth comparison, Pay-back comparison, Exercises and Discussion.

UNIT-II

Equivalent Annual worth Comparisons: 5 Hours

Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises and Discussion.

Rate of Return Calculations: 5 Hours

Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Exercises and Discussion.

UNIT-III

Depreciation: 5 Hours

Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts and types of tax.

Estimating and Costing: 5 Hours

Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal cost, Selling price, Estimation for simple components.

UNIT-IV

Introduction Financial Statements: 5 Hours

Statements of Financial Information: Introduction, Source of financial information, financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account.

Financial Ratio Analysis: 5 Hours

Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm's earning power. Comparative statements analysis.

Assignment:2 Quiz to be conducted

Course Outcomes: At the end of the course student will be able to

CO1 Demonstrate the role of economics in the decision-making process and develop the ability to account for time value of money using present work factors and formulas.
CO2 Evaluate the economic worth of alternatives based on their, annual equivalent-worth, rate-of return.
CO3 Compile the knowledge about the basic components of depreciation, estimation and costing.
CO4 Apply the knowledge of financial accounting & financial statements.Analyze the different financial ratios and draw inference.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 subdivisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl no	Title of the book	Name of the Author/s	Name of the publishers	Edition and year
Textbooks				
1	Engineering economics	James L. Riggs, David D. Bedworth, Sabah U. Randhawa	Tata McGraw Hill.	4th Ed, (2002) Thirteenth reprint(2010)
2	Engineering economics	Panneerselvam, R.	PHI Learning	Second edition (2013)
3	Engineering economy	Thuesen H.G.	PHI Learning	Second edition (2002)
Reference Books				
1	Basics of Engineering Economy,	Leland Blank & Anthony Tarquin	McGraw Hill Publication (India) Private Limited	8th Edition (2019)
2	Mechanical Estimating and Costing	T. R. Banga, S. C. Sharma	Khanna Publishers;	Seventeenth edition
3	Financial Management	I M Pandey	Vikas Publishing House;	Eleventh edition (2016)
4	Financial Accounting: Principles and Practices	Jawahar Lal, Seema Srivastava	S Chand Publishing;	Third edition (2014)

B. E. MECHANICAL ENGINEERING Semester - V			
PROJECT MANAGEMENT			
Course Code	**UME641 C**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)		**SEE Marks**	**100**
Credits	**3**	**SEE Exam Hours**	**03**

UNIT - I

Projects in Contemporary Organization: **05 Hours**

Definition, Why Project Management? Project Life Cycle, Project Management and the Project manager, Selecting the Project manager, Impact of Institutional Environments, Special demands of a Project manager, Information needs and the reporting process.

Market and Technical Appraisal: **05 Hours**

Introduction to Market Survey, Steps in Market survey, Demand Forecasting, Uncertainties in Demand forecasting, Choice of Technology for Production, Plant Capacity, Machinery and Equipment.

UNIT – II

Project Initiation: Strategic Management and Project Selection: **05 Hours**

Project Proposals, Numeric and Non-Numeric models for project selection, Criteria for choice for project selection, Nature of project selection models, Risk analysis of project under uncertainty.

Project Initiation: Project Organization and Planning: **05 Hours**

Functional Organization, Project Organization, Matrix Organization, Mixed Organization systems, Organizing Risk Management, Steps in Project planning, Project plan elements.

UNIT – III

Project Implementation: Scheduling and Control: **05 Hours**

Introduction to project scheduling, Network Techniques: PERT and CPM, Calculation of activity time, Critical path and time, Precedence Diagramming, Introduction to project control, Objectives/Purposes of project control, Types of project control process.

Project Implementation: Budgeting and Cost Estimating: **05 Hours**

Estimating project budgets: Top-Down budgeting, Bottom-Up budgeting, Work Element costing, An Iterative budgeting process.

UNIT – IV

Project Auditing: **05 Hours**

Purposes or Need of evaluation, The project audit, The project audit life cycle, Audit report: Preparation and Use.

Project Termination: **05 Hours**

Varieties of project termination, Termination by Extinction, Termination by Addition, Termination by Integration, Termination by Starvation, When to terminate a project, Termination process, Final report of project history.

Assignment: Quiz or Writeup

Course Outcomes: At the end of the course student will be able to

CO1 Explain the Concepts of PM in terms of Project Life Cycle, Project Managers, Selectionof Projects, Market Survey, Demand Forecasting and Choice of technology needed for projects.

CO2 Identify and Analyze the Skills, Abilities, Authorities and Responsibilities of a project manager. Reinforce project implementation techniques through Gantt chart, PERT and CPM

CO3 Exhibit attitude towards Co-ordination, Communication & information system required for a project. Perform scheduling, monitoring, and controlling the work-progress of a project.

CO4 Demonstrate effective & integrative Strategies, types & possible evaluation of project termination and display ethical dimensions of project inventory management.

Question Paper Pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Eachquestion carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No.	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1.	Project Management: A Managerial Approach	Jack R. Meredith, Samuel J. Mantel JR	Wiley India Edition	Fifth Edition Jan-2003
2.	Projects: Preparation, Appraisal, Budgeting, and Implementation	Prasanna Chandra	Tata McGraw Hill Publishing Company Limited, New Delhi,	Third Edition 1987
3.	Project Management	Dennis Lock	Publisher: Taylor & Francis	10th Edition Apl-2013
4.	A Guide to the Project Management Body of Knowledge (PMBOK Guide)	PMI (Project Management Institute)	PMI's flagship publication	6thEdition Aug-2021

B. E. MECHANICAL ENGINEERING Semester - V			
CAREER PLANNING AND PROFESSIONAL SKILLS			
Course Code	**UHS 003 N**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)		**SEE Marks**	**100**
Credits	**3**	**SEE Exam Hours**	**03**

B. E. MECHANICAL ENGINEERING SEMESTER-VI			
OPERATIONS RESEARCH			
Course Code	**UME604H**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:1:0**	**SEE Marks**	**100**
Credits	**3**	**SEE Exam (Hours)**	**03**

UNIT-I

INTRODUCTION **02Hours**

Definition, scope of Operations Research (OR) approach and limitations of OR Models, Characteristics, and phases of OR

LINEAR PROGRAMMING PROBLEMS **09 Hours**

Linear programming, graphical method, simplex method, Two-phase method, duality theory, dual simplex method.

UNIT-II

TRANSPORTATION PROBLEMS **06 Hours**

Mathematical model for Transportation problem, balanced and unbalanced transportation problem. Methods to solve transportation problem, finding basic feasible solution, testing solution for optimality.

ASSIGNMENT PROBLEMS **04Hours**

Formulation, unbalanced assignment problem, travelling salesman problem

UNIT-III

SEQUENCING 04 Hours

Johnson's algorithm, n - jobs to 2 machines, n - jobs 3machines, n -jobs m machines without passing sequence. 2 jobs n machines with passing. Graphical solutions priority rules.

PERT-CPM TECHNIQUES: 05 Hours

Project network construction, Critical Path Method (CPM), determination of critical path, Project Evaluation and Review Technique (PERT), probability of completing a project in a scheduled date.

UNIT-IV

GAME THEORY **05 Hours**

Laws of Probability, Formulation of games, two people-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), and dominance property.

REPLACEMENT MODELS **05 Hours**

Introduction, replacement of items whose maintenance and repair costs increase with time, ignoring changes in the value of money during the period, replacement of items whose maintenance costs increase with time and value of money also changes with time, replacement of items that fail suddenly, group replacement policy.

Assignment:

- Operations Research definition and origin.
- Essential features of the OR approach.
- Linear Programming – Graphical Solutions
- Linear Programming – Simplex Method for maximizing

- Example containing Duality Theory, The Primal Vs- Dual solutions
- TheTransportation ModelBasic Assumptions.
- The Assignment Model:-Basic Assumptions Solution Methods

Course Outcomes: At the end of the course student will be able to

CO1 Be able to understand the characteristics of different types of decision-making environments. and the appropriate decision-making approaches and tools to be used in each type.
CO2 Be able to build and solve Transportation Models and Assignment Models
CO3 Be able to design new simple models, like Sequencing, CPM, PERT to improve decision – Making and develop critical thinking and objective analysis of decision problems.
CO4 Be able to implement practical cases, by using Game theory and Replacement techniques

Question Paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 subdivisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl no	Title of the book	Name of the Author/s	Name of the publishers	Edition and year
Textbooks				
1	Operations Research	Prem Kumar Gupta, D S Hira	S Chand and Company Ltd., New Delhi	3rd Edition 2008
2	Operations Research	Panneerselvam R	Prentice – Hall of India, New Delhi	2002
Reference Books				
1	Operation Research	AM Natarajan, P. Balasubramani, A Tamilaravari	Pearson	2005
2	Operations Research	S. D. Sharma	Kedarnath Ramanath and Co	2008

B. E. MECHANICAL ENGINEERING SEMESTER-VI			
HEAT AND MASS TRANSFER LABORATORY			
Course Code	**UME606 L**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)		**SEE Marks**	**100**
Credits	**1**	**SEE Exam (Hours)**	**03**

PART – A

21 Hours

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
5. Determination of Heat Transfer Coefficient in a Forced Convention Flow through a Pipe.
6. Determination of Emissivity of a Surface.

PART – B

21 Hours

1. Determination of Stefan Boltzman Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers
3. Experiments on Boiling of Liquid and Condensation of Vapour
4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner
6. Experiment on Transient Conduction Heat Transfer

Course Outcomes: At the end of the course student will be able to

CO1 To be able to Define, understand, apply and analyze conduction heat transfer principles
CO2 To be able to Define, understand and analyze transient heat 14 transfer principles
CO3 To be able to Define, understand and analyze forced and free convection heat transfer principles
CO4 To be able to Define, understand and analyze the heat radiation, phase change heat transfer and mass transfer principles

Scheme of Examination:

One Question from Part A – 20 Marks (05 Write up +15)

One Question from Part B – 20 Marks (05 Write up +15)

Viva-Voce – 10 Marks

Total 50 Marks

B. E. MECHANICAL ENGINEERING SEMESTER-VI			
DYNAMICS LABORATORY			
Course Code	**UME608 L**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)		**SEE Marks**	**100**
Credits	**1**	**SEE Exam (Hours)**	**03**

Part 1 - Hydraulics

1. Hydraulic pump Characteristics
2. Pressure Intensification
3. Metre-in Circuit
4. Metre-out Circuit
5. Hydraulic Motor

Part 2 - Pneumatics

1. Direct and Indirect control of single acting cylinder
2. Direct and Indirect control of double acting cylinder
3. Supply air throttling
4. Exhaust air throttling
1. Memory Valve

Course Outcomes: At the end of the course student will be able to

CO1
CO2
CO3
CO4

Scheme of Examination:
One question from Part A – 20 Marks (05 Write up +15)
One question from Part B or Part C – 20 Marks (05 Write up +15)
Viva – Voce – 10 Marks
Total: 50 Marks

B. E. MECHANICAL ENGINEERING SEMESTER-VI			
INDUSTRIAL AUTOMATION LABORATORY			
Course Code	**UME609 L**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)		**SEE Marks**	**100**
Credits	**3**	**SEE Exam (Hours)**	**03**

Part 1 - Hydraulics

1. Hydraulic pump Characteristics
2. Pressure Intensification
3. Metre-in Circuit
4. Metre-out Circuit
5. Hydraulic Motor

Part 2 - Pneumatics

1. Direct and Indirect control of single acting cylinder
2. Direct and Indirect control of double acting cylinder
3. Supply air throttling
4. Exhaust air throttling
5. Memory Valve

Course Outcomes: At the end of the course student will be able to

CO1
CO2
CO3
CO4

Scheme of Examination:
One question from Part A – 20 Marks (05 Write up +15)
One question from Part B or Part C – 20 Marks (05 Write up +15)
Viva – Voce – 10 Marks
Total: 50 Marks

B. E. MECHANICAL ENGINEERING SEMESTER-VI			
MINI PROJECT			
Course Code	**UME 611 L**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)		**SEE Marks**	**100**
Credits	**1**	**SEE Exam (Hours)**	**03**