4th Semester

Basaveshwar Engineering College (Autonomous), Department of Mechanical Engineering
Scheme Autonomous Syllabus (175 credits) 2020-21 (Regular) and 2021-22(Lateral) Batch
B.E. IV SEMESTER

Sl. No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
01	UMA429C	Complex Analysis and Statistics	3	2	2	-	50	50	100
02	UME 415C	Applied Thermodynamics	3	2	2	-	50	50	100
03	UME 416C	Metrology & Instrumentation	3	3	-	-	50	50	100
04	UME 417 C	Machining and Machine Tools	3	3	-	-	50	50	100
05	UME 4XXC	Fluid Mechanics	3	2	2	-	50	50	100
06	UHS 001N	Fundamentals of Quantitative Aptitude and Soft Skills	1	2	-	-	50	50	100
07	UME 407L	Metrology & Instrumentation Lab	1	-	-	2	50	50	100
08	UME 408L	Machine Shop Lab	1	-	-	2	50	50	100
09	UME 421L	CAMD Lab	2	1	-	2	50	50	100
10	UMA 430M	**Bridge Course Mathematics-II	0	3	-	-	50	50	100
		Total Credits :	**20**	**18**	**06**	**06**	**500**	**500**	**1000**

****Bridge Course Mathematics – II is a mandatory subject only for diploma students admitted to BE 3rd Semester through Lateral Entry scheme during 2021-22 onwards. Passing the subject is compulsory: however marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for passing/not passing the subject respectively.

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 -IV			
Complex Analysis and Statistics			
Course Code	**UMA 429 C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	100
Credits	03	SEE Exam Hours	03

Unit –I

Complex Variables: **10 Hours**

Analytic function, Cauchy-Reimann equations in Cartesian and polar forms. Construction of analytic function (Cartesian and polar forms)

Unit-II

Complex Integration: **10 Hours**

Line integral, Cauchy's theorem – corollaries (without Proof), Cauchy's integral formula. Taylor's and Laurent's series (statements only), singularities, poles, calculation of residues, Cauchy's residue theorem (without proof) – problems.

Unit –III

Statistics and Probability **10 Hours**

Statistics: Curve fitting by the method of least squares: $y = a + bx$, $y = ab^x$ and $y = a + bx + cx^2$ Correlation and regression.

Probability: addition rule, conditional probability, multiplication rule, Baye's rule. Random variables, Problems on expectation and variance.

Unit –IV

Probability distributions: **10 Hours**

Binomial distributions Poisson distributions and Normal distributions(No drivations). Concept of joint probability, Joint distributions - discrete random variables, Markov chains:

Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.

Total: 40 Hours

Course Outcomes: To enable the students to apply the knowledge of Mathematics in various Engineering fields by making them

- **CO1** To attempt solve real world problems using complex variable techniques
- **CO2** To use the concept of complex integration technique's for solving engineering problems
- **CO3** To understand the concepts of curve fitting and probability.
- **CO4** To understand the concepts of probability distributions
- **CO5** To understand the concepts of probability distributions

Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. 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
Reference Books				
1	Higher Engineering Mathematics	Dr. B.S. Grewal	Khanna Publishers, New Delhi	
2	Theory and problems of probability	Seymour Lipschutz	Schaum's Series	
3	Advanced Engineering Mathematics	H. K. Dass		
4	Advanced Engineering Mathematics	E Kreyszig	John Wiley & Sons	
5	Probability and stochastic processes	Roy D. Yates and David J. Goodman	wiley India pvt.ltd	2nd edition 2012.

B. E. MECHANICAL ENGINEERING SEMESTER -IV			
APPLIED THERMODYNAMICS			
Course Code	**UME 415 C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	100
Credits	2-1-0	SEE Exam Hours	03

UNIT – I

Gas Power Cycles: (3+3) Hours

Air standard cycles- Carnot, Otto, Diesel, Dual and Stirling cycles, PV and TS diagrams, description / process, efficiency derivation, mean effective pressure derivation, comparison of Otto, Diesel and dual cycles; **Numerical Problems**.

Gas Turbines Cycles: (3+3) Hours

Gas Turbines (Simple and Ideal) - classifications, closed cycle – PV, TS diagram, description, efficiency derivation, work ratio derivation; open cycle- description /process, efficiency derivation; Advantages and disadvantages of closed cycle; **Numerical problems.**

UNIT- II

Gas Turbines: (2+2) Hours

Methods to improve thermal efficiency- regeneration, inter cooling, reheating, their PV, TS diagram, description / process.

Vapor Power Cycles(simple/Ideal) (4+4) Hours

Carnot vapour power cycle; drawbacks as a reference cycle; Simple Rankine cycle- description / process, PV, TS & line diagram, efficiency derivation; Comparison of Carnot and Rankine cycles; Effects of pressure and temperature on Rankin cycle performance, **Numerical problems** on above topics, Methods to improve performance of Rankine cycle: Practical regenerative Rankine cycle- TS, line diagram and description / process of open feed water heaters; Reheat Rankine cycle- TS, line diagram, process/description;.

UNIT - III

Reciprocating Compressors: (3+3) Hours

Air Compressor terminology; Operation of a single stage reciprocating air compressor; Work input of single stage- without clearance, representation on PV diagram for different processes, work done derivation for different process; Work input of single stage- with clearance, PV diagram, effect of clearance volume and volumetric efficiency; Adiabatic, isothermal and mechanical efficiencies; Multi-stage compressor- saving in work, optimum intermediate pressure, inter-cooling, minimum work for compression; **Numerical problems on single stage only**.

Refrigeration:(simple/Ideal) (4+4) Hours

Vapour compression refrigeration system- dry compression, wet compression, superheated & sub cooling compression, their PH, TS diagram, description/process, analysis: refrigerating effect, mass flow rate of refrigerant, theoretical piston displacement, actual piston displacement, refrigerating capacity (TR), power required, COP, analysis based on per TR; **Numerical Problems**; Air cycle refrigeration: reversed Carnot cycle, analysis as flow system; Reversed Brayton cycle- analysis as flow system;

UNIT - IV

Psychometrics: (7+7) Hours

Atmospheric air and psychometric properties- Dry bulb temperature, wet bulb temperature, dew point temperature, partial pressures, specific humidity, relative humidity, degree of saturation, enthalpy of moist air; Use of psychometric chart; **Numerical problems.**

I.C. Engines:
Geometrical properties of reciprocating engines; Performance parameters - indicated work, BP, IP, MEP, SFC, SEC, A/F ratio, equivalence ratio, efficiencies (mechanical, thermal / fuel conversion, volumetric), engine specific weight, engine specific volume; Methods of FP calculation; Measurement of fuel consumption and air consumption; Heat balance sheet; **Numerical problems**.

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

CO1 Students will demonstrate the ability to perform analysis of thermodynamic systems and air standard cycles (Otto, Diesel, dual, Stirling) and to perform appropriate calculations including those applicable to internal combustion engines. Also compare and discuss performance between Otto, Diesel and Dual thermodynamic cycle. Students will demonstrate the ability to perform analysis of thermodynamic gas power cycles Brayton. Students will do appropriate calculations.

CO2 Students will demonstrate the ability to perform analysis of modified Brayton cycle. They discuss the performance analysis of simple and modified Brayton cycle. Student will understand the components and basic assumptions for the Rankine cycle and analyze and design steam power plants including systems with reheat and regeneration. They calculate and discuss performance of simple and modified Rankine cycle.

CO3 Student will demonstrate the ability to do thermodynamic analysis (single and multi-stage, single acting and double acting) of reciprocating compressor and optimize the power in put calculation.

CO4 Students will demonstrate the ability to apply psychrometrics and thermodynamics to analysis of heating, cooling. Students will do appropriate calculate required for air conditioning equipment.

Student will analyze the performance (BP, IP, BSFC, ISFC, BSEC, BTE, ITE, Volumetric efficiency, Mechanical Efficiency,) /heat balance sheet of internal combustion engine. They also discuss the performance data analysis

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 Publishers	Edition and Year
Textbook/s				
1	Applied Thermodynamics	B.K.Venkanna & Swati.B. Wadawadagi	PHI New Delhi	Any edition
2	Internal Combustion Engines	V.Ganeshan	Tata Mcgrawhill	Any edition
Reference Books				
1	Thermodynamics–A Engineering Approach	Yunus, A.Cenegal and Michael A.Boles	Tata McGraw Hill Pub. Co., 2002	
2	Fundamental of Classical Thermodynamics	G.J. Van Wylen and R.E.Sonntag		Any edition
3	A Course in I.C.Enginesy M. L Mathur, R.P. Sharma	M. L Mathur, R.P. Sharma	DhanpatRai& Sons	Any edition
Data Hand Book:				
[1] Thermodynamic data handbook by Nijaguna & Samaga				
[2] Refrigeration and Air conditioning data hand book				

B. E. MECHANICAL ENGINEERING SEMESTER - IV			
METROLOGY AND INSTRUMENTATION			
Course Code	**UME416C**	CIE Marks	50
Teaching Hours/ week	3:0:0	SEE Marks	100
Credits	3	SEE Exam Hours	03

UNIT- I

STANDARDS OF MEASUREMENT: **10 Hours**

Definition and Objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, subdivision of standards, line and end standard, comparison, transfer from line standard to end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-87, M-112), Numerical problems on building of slip gauges.

SYSTEM OF LIMITS, FITS, TOLERANCES AND GAUGING:

Definition of tolerance, Specification in assembly, Principle of inter changeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances accumulation of tolerances, definition of fits, types of fits and their designation (IS 919 -1963), geometrical tolerance, positional - tolerances, hole basis system, shaft basis of system, classification of gauges, brief concept of design of gauges (Taylor's principles), Types of gauges -plain plug gauge, ring gauge, gauge materials.

UNIT- II

COMPARATORS AND ANGULAR MEASUREMENT: **10 Hours**

Introduction to Comparator, Characteristics, classification of comparators, mechanical comparators - Johnson Microcenter, Sigma Comparators, dial indicator, Optical Comparators -principles, Zeiss ultra optimeter, Electrical Comparators - principles, LVDT, Pneumatic Comparators, back pressure gauges, Solex Comparators. Angular measurements, Bevel Protractor, Sine Principle and. use of Sine bars, Sine center, angle gauges, Clinometers

INTERFEROMETER AND SCREW THREAD GEAR MEASUREMENT:

Interferometer Principle of interferometer. Optical flats. Terminology of screw threads, measurement of effective diameter of screw threads by 3-wire method, Best size wire. Toolmakers microscope, gear terminology, use of gear tooth Vernier caliper and gear tooth micrometer

UNIT- III

MEASUREMENTS AND MEASUREMENT SYSTEMS: **10 Hours**

Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hystersis, repeatability, linearity, loading effect. Errors in Measurements, Classification of Errors. Transducers, Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, advantages of each type transducers.

INTERMEDIATE MODIFYING AND TERMINATING DEVICES:

Mechanical systems, inherent problems, Electrical intermediate modifying devices, input circuitry and telemetry. Terminating devices, Mechanical, Cathode Ray Oscilloscope, Oscillographs, X-Y Plotters.

UNIT-IV

MEASUREMENT OF FORCE AND TORQUE, PRESSURE **10 Hours**

Principle, analytical balance, proving ring, Torque measurement, Prony brake, hydraulic dynamometer. Pressure Measurements, Principle, use of elastic members, Bridgeman gauge, Mcloed gage, Pirani Gauge.

TEMPERATURE AND STRAIN MEASUREMENT:

Resistance thermometers, thermocouple, law of thermocouple materials used for construction, pyrometer, Optical Pyrometer. Strain Measurements, Strain gauge, methods of strain measurement.

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: Upon successful completion of this course, the students will be able to:

- **CO1** *Understand* the basics of metrology and instrumentation, *classify, compare and choose* various linear standards. Can *understand, choose and make use* of slip gauges to build the required linear dimensions. Can *apply* the knowledge of limits, fits and tolerances in solving assembly problems.
- **CO2** *Classify and understand* the working of various comparators, sine bar, sine centre and angular measurement instruments. *Apply the knowledge* of interferometer, tool maker's microscope, gear tooth micrometer and optical flats for fine measurements.
- **CO3** Easily *identify* the stages of measurement systems and *understand the importance* of each stage (transducers, intermediate modifying and terminating stages) in measurement. Also *make use of the knowledge* of basic concepts related to measurement systems, *identify and classify* errors in measurements.
- **CO4** *Understand and apply the knowledge* of working principle and construction of instruments used for the measurement of force, torque, pressure, temperature and strain measurements.

Question paper pattern:

1. Total of **eight questions** with **two from each unit** to be set uniformly covering the **entire syllabus**.
2. **Each question carries 20 marks** and should not have more than 4 sub divisions.
3. **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
Textbook/s				
1	Mechanical measurements	Beckwith Marangoni and Lienhard	Pearson Education	6th Ed., 2006
2	Engineering Metrology	R. K. Jain	Khanna Publishers	1994
Reference Books				
1	Engineering Metrology	I. C. Gupta	Dhanpat Rai Publications	
2	Industrial Instrumentation	Alsutko, Jerry. D. Faulk	Thompson Asia Pvt. Ltd	2002
3	Measurement Systems Applications and Design	Ernest O, Doeblin	McGRAW Hill Book Co	

B.E. MECHANICAL ENGINEERING SEMESTER- IV			
MACHINING AND MACHINE TOOLS			
Course Code	UME 417C	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	100
Credits	03	SEE Exam Hours	03

UNIT - I

Theory of Metal Cutting: **12 Hours**

Single point cutting tool nomenclature, geometry, orthogonal and oblique cutting, mechanism of chip formation, types of chips, shear angle relationship, Merchants circle diagram and analysis (Relation of orthogonal cutting forces), Ernst Merchant's solution, stress and strain in the chip, power and energy relations in metal cutting, problems of Merchant's analysis, tool wear and tool failure, tool life, effects of cutting parameters on tool life, tool failure criteria, causes of wear, Taylor's tool life equation, problems on tool life evaluation.

UNIT - II

Turning, Shaping and Planing Machines: **10 Hours**

Classification, constructional features of turret and capstan lathe (Including tool layout, process chart), shaping and planing machines, specification of shaping and planing machines, drive mechanisms of lathe, shaping and planing machines, quick return mechanisms, hydraulic quick return mechanism, motor drive mechanism, table feed mechanism, operations on turret and capstan lathe, shaping and planing machines, problems of machining time for lathe, shaper and planner.

Drilling Machines:

Types of drilling machines, drill drive mechanism, drilling operations, drill bit nomenclature, types of drills, drill materials, estimation of machining time in drilling.

UNIT – III

Milling Machines: **10 Hours**

Classification, up milling and down milling concepts, constructional features, nomenclature, milling cutters, milling operations, Indexing: simple, compound, differential and angular indexing calculations, problems on simple and compound indexing.

Cutting Tool Materials:

Desired properties, selection of tool materials, types of cutting tool materials. Cutting fluids, desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation, heat distribution in tool and work piece, measurement of tool tip temperature.

UNIT - IV

Grinding Machines: **10 Hours**

Types of abrasives, bonding process, classification of grinding machines, constructional features, cylindrical, surface and centerless grinding machines, grinding wheel preparation, fixing of grinding wheel, specification of grinding wheel.

Broaching and Finishing Processes:

Broaching, Lapping, Honing, Buffing, Super finishing and Polishing: Principles of operation, types, construction and applications.

Non Traditional Machining: Introduction, need, classification, principle, metal removal and equipment in USM, ECM, EDM and PAM, advantages, disadvantages and applications.

Assignments: Quiz/presentation/set of questions covering entire syllabus.

Course Outcomes: Upon successful completion of this course, the students will be able to:

- **CO1** Compare and select the tool materials, geometries for different metals and analyze the cutting forces, tool life and summarize the effect of cutting parameters
- **CO2** Demonstrate the knowledge of, constructional features of various types of machine tools, different mechanisms, cutting fluids and their uses.
- **CO3** Prepare process chart and work on basic machine tools to perform different operations and estimate machining time.
- **CO4** Analyze nontraditional machining and conventional machining processes with respect to their mechanism of material removal, advantages, limitations and applications.

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 Publishers	Edition and Year
Textbook/s				
1	Workshop Technology Vol-II	Hazara Choudhry	Media Promoters and Publishers Pvt. Ltd.	14, 2014
2	Production Technology	R.K.Jain	Khanna Publications	2003
3	Production technology	HMT	Tata MacGraw Hill	2001
Reference Books				
1	Manufacturing Science	Amitabha Ghosh and Mallik	Affiliated East West Press	2003
2	Production Technology	P. C. Sharma	S. Chand & Company Pvt. Ltd.	8, 2014
3.	Fundamentals of Machining and Machine Tools	G. Boothroyd, Winston A. Knight	MARCEL DEKKER, INC	2, 2005
4	Production Engineering	P. C. Pandey, C. K. Singh	Standard Publishers Distributors	10, 2016

B. E. MECHANICAL ENGINEERING 03 Hours SEMESTER – V			
FLUID MECHANICS			
Course Code	UME513C	CIE MARKS	: 50
Teaching Hours/Week (L:T:P)	2:2:0	SEE MARKS	: 100
Credits	3	SEE Exam Hours	: 3 Hrs

UNIT –I

Introduction **03 Hours**

Properties of Fluids: Introduction, properties of fluids, viscosity, thermodynamic properties, Surface tension and Capillarity, Vapour pressure and Cavitation, Numerical problems.

Fluid Statics: **08 Hours**

Fluid pressure at a point, Pascal's law, Pressure variation in a static fluid, Absolute, gauge, atmospheric and vacuum pressures, Simple manometers, differential manometers, Total pressure and center of pressure, Vertical plane surface submerged in a liquid, Horizontal plane surface submerged in a liquid, Inclined plane surface submerged in a liquid, Curved surface submerged in a liquid, Buoyancy, center of buoyancy, metacenter and metacentric height, Conditions of equilibrium for floating and submerged bodies, Numerical problems.

UNIT –II

Fluid Kinematics: **05 Hours**

Introduction, Types of fluid flow, Continuity equation, continuity equation in three dimensions (Cartesian co-ordinate system only), Velocity and acceleration, Velocity potential function and stream function, Numerical problems.

Dimensional Analysis: **05 Hours**

Introduction, Derived quantities, Dimensions of physical quantities, Dimensional homogeneity, Buckingham's ∏ theorem, Raleigh's method, Dimensionless numbers, Similitude and types of similitude, Numerical problems.

UNIT – III

Fluid Dynamics: **03 Hours**

Introduction, Equations of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, Bernoulli's equation for real fluids, Numerical problems.

Fluid flow measurements: **03 Hours**

Introduction, Venturimeter, Orifice meter and Pitot tube, Discharge over rectangular and triangular notches, Numerical problems.

Flow through pipes: **05 Hours**

Frictional loss in pipe flow, Darcy- Equation for loss of head due to friction in pipes, Chezy's equation for loss of head due to friction in pipes, Hydraulic gradient and total energy line, Minor loses in pipes, Sudden enlargement, Sudden contraction, Obstruction, Bend, Elbow, Numerical problems.

UNIT – IV

Laminar flow and viscous effects: **03 Hours**

Reynold's number, Critical Reynold's number, Laminar flow through circular pipe-Hagen Poiseulle's equation, Laminar flow between parallel stationery plates, Numerical problems.

Flow past immersed bodies: **03 Hours**

Drag, Lift, Expression for lift and drag, Pressure drag, Friction drag, Boundary layer concept, Displacement thickness, Momentum thickness and energy thickness, Numerical problems.

Introduction to compressible flow: **04 Hours**

Velocity of sound in a fluid, Velocity of sound in terms of Bulk modules, Velocity of sound for isothermal process, Velocity of sound for adiabatic process.

Mach number, Subsonic, Sonic and Supersonic flows, Propagation of disturbance for different Mach numbers, Mach cone, Stagnation properties, Stagnation Pressure, Stagnation temperature, Area velocity relationship for compressible flow, Numerical problems

Assignment: As decided by the Course Instructor

Course Outcomes: Upon successful completion of this course, the students will be able to:

- **CO1** *Apply* the knowledge of fluid mechanics in selecting the types of fluids required for various engineering applications.
- **CO2** *Apply* the knowledge of fluid mechanics to *analyze* the fluid engineering problems by the method of dimensional analysis.
- **CO3** *Apply* the knowledge of fluid mechanics to *analyze* the fluid flow problems.
- **CO4** *Apply* the knowledge of fluid mechanics to *analyze* viscous and compressible fluid flow 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 sub divisions.
- Any five full questions are to be answer 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	Fluid Mechanics (SI Units)	Yunus A. Cingel John M. Oimbala	Tata McGraw-Hill	2006
2	Fluid Mechanics and hydraulics	Dr. Jagadishlal	Metropolitan Book Co-Ltd.	1997
3	Fluid Mechanics	Dr.R.KBansal	Lakshmi Publications	2004
4	Hydraulics and Fluid Mechanics	Modi P N and S M Seth	Standard Publication	2005
Reference Books				
1	Fluid Mechanics	Oijush K. Kundu, Iram Cochen	Elsevier	3rd Edition. 2005.
2	Fluid Mechanics	John F. Douglas, Janul and M. Gasiosek and john A. Swaffield	Pearson Education Asia	5thedition. 2006
3	Fluid Mechanics and Fluid Power Engineering	Kumar.D.S	Kataria and Sons	2004
4	Essential Computational Fluid Dynamics	Oleg Ziaanov	Jhon Wiley	
5	1000 Solved Problems in Fluid Mechanics	Subramanya K	TMH	2006

B.E. MECHANICAL ENGINEERING SEMESTER- IV			
Fundamentals of Quantitative Aptitude and Soft Skill			
Course Code	UHS 001 N	CIE Marks	50
Teaching Hours/Week (L:T:P)		SEE Marks	100
Credits		SEE Exam Hours	03

B.E. MECHANICAL ENGINEERING SEMESTER- IV			
Metrology & Instrumentation Lab			
Course Code	UME 407 L	CIE Marks	50
Teaching Hours/Week (L:T:P)	0-0-2	SEE Marks	100
Credits	01	SEE Exam Hours	03

INSTRUMENTATION

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART-B:

METROLOGY

6. Measurements using Optical Projector / Toolmaker Microscope / Profile projector.
7. Measurements of angle using Sine Center / Sine bar / bevel protractor
8. Measurements of alignment using Autocollimator / roller set
9. Measurements of cutting tool forces using

a) Lathe tool Dynamometer – construction and analysis of Merchants circle diagram.

b) Drill tool Dynamometer.

10. Measurements of Screw thread Parameters using two wires or three-wire methods.
11. Measurements of Surface roughness. Using Tally surf/mechanical Comparator.
12. Measurements of gear tooth profile using gear tooth vernier /gear tooth micrometer.
13. Calibration of micrometer using slip gauges
14. Measurement on the using Optical Flats.

Laboratory Assessment:

1 Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2 The CIE in laboratory in classes is carried out for 50 marks (30 marks for the performance and term work)
3 For remaining 20 marks one practical test to be conducted

The SEE practical is conducted for 50 marks two question to be set from each Part A, and Part B. for 20 marks each and 10 marks Viva voce.

CO1
CO2
CO3
CO4

B.E. MECHANICAL ENGINEERING SEMESTER- IV			
Machine Shop Lab			
Course Code	UME 408 L	CIE Marks	50
Teaching Hours/Week (L:T:P)	0-0-2	SEE Marks	100
Credits	01	SEE Exam Hours	03

Part – A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning. Determination of gear train for thread cutting. Preparation of the process chart for the component.

PART - B

Cutting of V Groove/ dovetail / Rectangular groove using Shaping and Cutting of Gear Teeth using Milling Machine. Planning machine. Estimation of stroke length, Number of strokes, Estimation of rpm, Preparation of process chart for the component.

Laboratory Assessment:

1. Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. The CIE in laboratory in classes is carried out for 50 marks (30 marks for the performance and term work)
3. For remaining 20 marks one practical test to be conducted

The SEE practical is conducted for 50 marks two question to be set from each Part A (Process chart five marks + 15 marks for job) and Part B (Process chart and programming 15 marks + Virtual machining 5 marks). for 20 marks each and 10 marks Viva voce.

CO1
CO2
CO3
CO4

B.E. MECHANICAL ENGINEERING SEMESTER- IV			
Computer Aided Machine Drawing Lab			
Course Code	UME 411 L	CIE Marks	50
Teaching Hours/Week (L:T:P)	1-0-2	SEE Marks	100
Credits	02	SEE Exam Hours	03

Part A

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections.

Orthographic views: Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed fo r the drawings) Hidden line conventions. Precedence of lines.

Thread forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

Part B

Keys & Joints:
Parallel key, Taper key, Feather key, Gibhead key and Woodruff key.

Riveted Joints: single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

Couplings:
Flanged coupling and universal coupling (Hooks' Joint)

Part C

Assembly Drawings (Part drawings should be given)
1. Plummer block (Pedestal Bearing)
2. I.C. Engine connecting rod
3. Screw jack (Bottle type)
4. Tailstock of lathe
5. Machine vice
6. Tool Head of shaper

CO1 To define basic sketching commands and navigational commands used in SOLID EDGE software
CO2 To understand conversion of pictorial views into orthographic projections of simple machine parts with or without section
CO3 To understand thread terminology, sectional views of threads, ISO Metric, BSW, square, Acme and Sellers thread, fasteners, joints and Couplings
CO4 To develop solid models (3D drawings) of various machine parts and develop assembly using solid edge software. To explain and draw 2D drawings in assembly or in single unit

Laboratory Assessment:

1. Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. The CIE in laboratory in classes is carried out for 50 marks (30 marks for the performance and term work)
3. For remaining 20 marks one practical test to be conducted for sketching and printouts from SOLID EDGE.

The SEE practical is conducted for 50 marks of three hour duration two question to be set from each Part A, Part B and Part C. Student has to answer one question each from Part A and Part B for 10 marks each and one question from part C for 30 marks

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	A Primer on Computer Aided Machine Drawing-2007		VTU, Belgaum	
2	Machine Drawing	N.D.Bhat & V. M. Panchal		
3	Machine Drawing	N. Siddeshwar, P. Kanniah, V.V.S. Sastri	Tata Mc GrawHill	2006
Reference Books				
1	A Text Book of Computer Aided Machine Drawing	S. Trymbaka Murthy	CBS Publishers, New Delhi	2007

B.E. MECHANICAL ENGINEERING SEMESTER- IV			
Bridge Course Mathematics - II			
Course Code	UMA 430 M	CIE Marks	50
Teaching Hours/Week (L:T:P)		SEE Marks	100
Credits	00	SEE Exam Hours	03

Ordinary differential equations of first order: **15 Hours**

Variable seperable,Homogeneous.Exact form and reducible to exact differential equations. Linear and Bernoulli's equation.

Differential Equations of higher order:

Second and higher order linear ODE's with constant coefficients-Inverse differential operator, method of variation of parameters(second order); Cauchy's and Legendre homogeneous equations.

Laplace Transform: **15 Hours**

Introduction, Definition of Laplace Transform, Laplace Transform of Elementary functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function Inverse Laplace transforms – Properties. Convolution theorem. Solutions of linear differential equations

Partial Differential Equations(PDE's): **10 Hours**

Introduction to PDE : Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Solution of Lagrange's linear PDE, method of separation of variables,

CO1 Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations

CO2 Apply the Laplace transform techniques to solve differential equations

CO3 Understand a variety of partial differential equations and solution by exact methods

CO4
- solve PDE by direct integration and Solution of Lagrange's linear PDE, method of separation of Variables

Question paper pattern for SEE

1. Total of eight questions uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered