BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102Department of Mechanical Engineering

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

B.E. III SEMESTER

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1.	UMA329C	**Numerical Techniques & Fourier Series**	3	3	-	-	50	50	100
2.	UME311C	Material Science & Metallurgy	3	3	-	-	50	50	100
3.	UME313C	Basic Thermodynamics	3	2	2	-	50	50	100
4.	UME314C	Strength of Materials	3	2	2	-	50	50	100
5.	UME312C	Foundry and Welding Tech	3	3	-	-	50	50	100
6.	UME315C	Theory of Machines	3	3	-	-	50	50	100
7.	UME307L	Material Science & Material Testing Lab	1	-	-	2	50	50	100
8.	UME310L	Mechanical Drawing Lab	1	-	-	2	50	50	100
9.	UME308L	Foundry & Forging Lab	1	-	-	2	50	50	100
10.	UME 3XX O	***Online Course-I**	1	-	-	-	-	-	-
11.	UMA 330 M	****Bridge Course Mathematics-I**	-	3	-	-	50	50	100
12.	UBT 133 M	Environmental Studies	-	2	-	-	50	50	100
13.	UHS388C	Samskruthika Kannada[#]	1	2	0	0	50	50	**100**
		or							
	UHS389C	Balake Kannada[$]							
Total Credits :			**23**	**23**	**04**	**06**	**600**	**600**	**1200**

***Online course options:**

1. The course should be of minimum 04 weeks duration to earn 01 credit
2. Online course should be a subject other than the enlisted above.

****Bridge Course Mathematics – I and Environmental Studies** are 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.

BVVS

UME 329C	NUMERICAL TECHNIQUES & FOURIER SERIES	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT - I	10 Hrs.

Numerical Analysis-I:

Introduction to find root finding problems, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae (without proof).Lagrange's and Newton's divided difference interpolation formulae (without proof) Numerical differentiation using Newton's forward and backward formulae-problems.

UNIT – II	10 Hrs.

Numerical analysis-II:

Numerical Integration: Simpson's one third rule, Simpson's three eighth rule (no derivation of any formulae)-problems. Numerical solution of ODE and PDE: Euler's and Modified Euler's method, Runge-Kutta 4th order method, Numerical solutions of one-dimensional heat and wave equations by explicit method, Laplace equation by using five point formula.

UNIT – III	10 Hrs.

Fourier Series:

Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

UNIT – IV	10 Hrs.

Fourier transforms: Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms.

Reference books:

1. Numerical Methods for Engineers by Steven C Chapra& Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)

Course Outcomes:

On completion of this course, students are able

1. To know how root finding techniques can be used to solve practical engineering problems.
2. To apply the concept of finding approximate value of the derivative & definite integral for a given data
3. Using numerical techniques.
4. To apply numerical techniques to solve the first order first degree ordinary differential equations.
5. To apply partial differential techniques to solve the physical engineering problems.
6. To implement integration technique to determine the extreme values of a functional.

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.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

Course Outcomes	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	--	--	--	--	--	--	--	--	--	--
CO2	1	2	--	--	--	--	--	--	--	--	--	--
CO3	1	2	--	--	--	--	--	--	--	--	--	--
CO4	1	2	---	--	--	--	--	--	--	--	--	--
CO5	1	--	--	--	---	--	--	--	--	--	--	--

UME 311 C	**MATERIALS SCIENCE AND METALLURGY**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**

Structure of Crystalline Solids:
Fundaments concepts of unit cell, space lattice, Bravaias space lattices, unit cells for cubic structure and HCP, coordination numbers and atomic packing factor for different cubic structures. Crystal imperfections – point, line, surface and volume defects. Diffusion mechanism, Fick's laws of diffusion.

Concepts of stress and strain, tensile properties, Impact test of materials, Hardness – Rockwell, Vickers and Brinell hardness testing. Plastic deformation.

UNIT – II	**10 Hrs**

Fatigue, Creep and Fracture: Fatigue: fracture tests, S-N curves, factors affecting fatigue life and protection methods. Creep: the creep curves, mechanism of creep, creep resistant materials. Types, stages in cup and cone fracture.

Solid solutions: Types, rules of governing the formation of solid solutions. Phase diagrams: basic terms, Gibbs phase rules, cooling curves, construction of phase diagrams, interpretation of equilibrium diagrams (use of tie line and Lever rule), types of phase diagrams (Eutectic systems, peritectic, eutectoid, peritectoid reactions).

UNIT – III	**10 Hrs**

Equilibrium phase Diagrams: Iron – iron carbide equilibrium phase diagram, phases in Fe-Fe3C system, invariant reactions, microstructure of slowly cooled steels, effect of alloying elements on Fe-Fe3C diagram. The TTT diagrams, drawing of TTT diagrams, TTT diagrams for eutectoid steels, effect of alloying elements.

Heat Treatment: Annealing, normalizing, hardening, Induction hardening, harden ability, Jominy end-quench test.

UNIT – IV	**10 Hrs**

Engineering Alloys: Properties, composition and uses of low carbon, mild medium and high carbon steels, cast Irons, gray CI, white CI, malleable CI, SG iron. The light alloys, Al and Mg and Titanium alloys. Copper and its alloys: brasses and bronzes.

Corrosion: Corrosion and its prevention: Galvanic cell, the electrode potentials, polarization, passivation. General methods of corrosion prevention by alloying, stress corrosion cracking.

Reference Books:

1. "Introduction to Material Science for Engineering", 6th edition James F. Shackel ford. Pearson, Prentice Hall,New Jersy, 2006.
2. "Physical Metallurgy, Principles & Practices", V Raghavan.PHI 2nd Edition 2006, NewDelhi. 2. "Foundation of Material Science and Engineering", Smith, 3rd Edition McGraw Hill, 1997.
3. "Materials Science & Engineering- An Introduction", William D.Callister Jr. Wiley India Pvt. Ltd. 6th Edition, 2006, New Delhi.
4. "Essentials of Materials For Science And Engineering", Donald R. Askeland, Pradeep P.PhuleThomson Engineering, 2006.

Course Outcomes:

At the end of the course, the students will be able to:

1. Gain understanding of the relationships between the structures, properties and applications of various engineering material and understand various mechanical properties of materials.
2. Gain the knowledge of various modes of failure of materials, also to understand and interpret solid solution and various phase diagrams
3. Gain the knowledge of Fe-Fe_3C equilibrium phase diagrams and to understand various heat treatment processes and their applications.
4. Understand the composition and properties of various engineering alloys. Understand the process of corrosion, its causes and preventive methods.

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.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
1	1	2	--	--	3	1	2	2	3	--	1	--
2	3	2	3	--	1	2	--	1	3	2	3	2
3	1	1	2	1	1	3	--	1	2	2	3	1
4	3	2	3	2	3	1	2	--	3	1	2	--

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 312 C	Foundry & Welding Technology	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs
Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process. Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns. **Binder:** Definition, Types of binder used in mouldings and. **Additives:** Need, Types of additives used. **Sand Moulding :** Types of base sand, requirement of base sand. Types of sand moulds.Moulding sand mixture ingredients (base sand, binder & additives. Method used for sand moulding. **Cores:** Definition, Need, Types. Method of making cores, Binders used. Concept of Gating &Risering. Casting defects causes, features and remedies.	
UNIT – II	**10 Hrs**
SPECIAL MOULDING PROCESSES : **Study of important moulding processes:** Green sand, Core sand, Dry sand, Sweep mould, CO2 mould, Shell mould, Investment mould& Full mould. **Metal moulds:** Gravity die-casting, Pressure die casting, centrifugal casting, Squeeze Casting, Slush casting and continuous casting processes.	
UNIT – III	**11 Hrs**
WELDING **Welding process:** Definition, Principles, Classification, Application, Advantages & limitations of welding. **Arc Welding:** Principle, Metal Arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding processes. (AHW) **Gas Welding:** Principle, Oxy – Acetylene welding, Reaction in Gas welding, Flame characteristics, Gas torch construction & working. Forward and backward welding. Special type of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.	
UNIT – IV	**09 Hrs**
METALLURGICAL ASPECTS IN WELDING Structure of welds, Formation of different zones during welding. Heat affected zone (HAZ). Concept of electrodes, Filler rod and fluxes. Welding defects – Detection causes & remedy. **Inspection Methods** – Types of inspection .NDT inspection (Advnatges) Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography inspection	

Reference Books:

1. "Manufacturing Technology", SeropeKalpakjain, Steuen. R. Sechmid, Pearson Education Asia, 5th Ed.2006
2. "Process and Materials of Manufacturing" Roy A Lindberg, 4th Ed. Pearson Edu.2006.
3. "Manufacturing & Technology: Foundry Forming and Welding",P.N.Rao 2nd Ed., Tata McGraw Hill, 2003.
4. "Manufacturing Process-I", Dr.K.Radhakrishna, Sapna Book House,5th Edition 2006..

Course Outcomes:

At the end of the course, the students will be able to:

1. Select suitable manufacturing processes to manufacture the products optimally
2. Explain the technology, variables and complexity involved in producing a casting.
3. Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application
4. Interpret metallurgical aspects in welding, inspection methods for the quality assurance of components made of casting and welding process

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.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1	1	--	--	--	--	2	--	--	1
2	3	1	--	--	1	1	1	1	2	--	--	--
3	3	3	2	2	--	1	1	1	2	2	1	2
4	2	3	2	1	--	1	1	1	2	--	1	2

UME 313 C	**BASIC THERMODYNAMICS**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Work & Heat: Definition of work-according to mechanics, according to thermodynamics, examples, sign convention; Displacement work- PdV expressions for displacement work in various processes through p-v diagrams, Other types of work – shaft work, paddle wheel work, working straining a bar, free expansion work, electrical work; Heat- definition, units and sign convention; Comparison and differences between work and heat, Numerical Problems **First Law of Thermodynamics:** Joule's experiments; Statement of the First law of thermodynamics- cyclic, non-cyclic processes; Energy- modes of energy, internal energy, internal energy as a property; Specific heat- at constant volume, at constant pressure; Enthalpy; Extension of the First law to control volume- steady state-steady flow energy equation, important applications with line diagram, Numerical Problems.	
UNIT – II	**10 Hrs**
Second Law of Thermodynamics: Energy- High grade, low grade; Heat reservoirs-heat source and heat sink; Heat engines-definition, schematic representation, thermal efficiency; Reversed heat engines-refrigerator, heat pump, COP; Second Law of Thermodynamics- Kelvin -Planck statement, PMM II, Clasius's statement; Equivalence of the two statements; Reversible and irreversible process – definition, factor that make a process reversible and irreversible; Carnot cycle- processes involved in Carnot cycle, PV, TS and line diagram; Carnot principles; Thermodynamic temperature scale. Numerical Problem. **Entropy:** Carnot theorem; Clausius theorem; Entropy – property of a system; Clausius inequality- statement, proof, application to a reversible cycle; Entropy change of an irreversible process of a closed system; Principle of increase of entropy; Calculation of entropy using TdS relations, simple problems based on processes.	
UNIT – III	**11 Hrs**
Pure substances: Pure substances-definition, examples, PT and PV diagrams, triple point, critical points, sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapour states of a pure substance with water as example; Enthalpy- sensible, latent, total, super heat; Dryness factor (quality); TS and HS diagrams and representation of various processes on these diagrams, Separating and throttling calorimeter-description, line diagram. Numerical Problems.	
UNIT – IV	**09 Hrs**
Real gases: Introduction; Van der Waal's Equation; Van der Waal's constants in terms of critical properties; Reduced properties; Van der Waal's equation in terms of reduced properties; Compressibility factor; Generalized compressibility chart; Principles of corresponding states, Numerical Problems. **Ideal gases:** Equation of state; Internal energy and enthalpy as functions of temperature only; Universal and particular gas constants; Evaluation of heat, work, change in internal energy, enthalpy and entropy in various quasi-static processes; Ideal gas mixture-mass fractions, mole fractions, molecular weight of the mixture of ideal gases, Dalton's law of additive pressures, Amagat's law of additive volumes, evaluation of properties, Numerical Problems.	

Reference Books:

1. Advanced Engineering Thermodynamics, Adrian Bejan,2006, 3rd Edition, John wiely
2. Engineering Thermodynamics, Jones J B and R E Dugan,1996, PHI.
3. Classical Thermodynamics, Van Wylen G J,1998, 2nd Edition, WielyEstern Ltd.
4. Basic Thermodynamics, by B.K.Venkanna and Swati B Wadawadagi, PHI Learning Pvt Ltd, New Delhi, 1st Edition.
5. Thermodynamics Engineering Approach, by Yunus A. Cenegal and Michael A. Boles, Tata McGraw Hill, 2002

Course Outcomes:

At the end of the course, the students will be able to:

1. Define the concepts of heat, work, and energy, develop/analyze energy application device. Demonstrate a basic understanding of the First Law of Thermodynamics for energy conservation analysis of different thermodynamics processes of systems and control volumes and to estimate required balances of heat, work and energy flow (heaters, coolers, pumps, turbines, pistons, etc.).
2. Demonstrate a basic knowledge of the Second Law of Thermodynamics and its corollaries to determine whether a cycle is possible, and to determine the maximum performance/efficiency of cycles and its application to systems and control volumes. Use second Law of Thermodynamics for entropy balance analysis of different Thermodynamics processes of systems and control volume to solve problems in thermodynamics.
3. Use steam tables, equations, and charts, in evaluation of thermodynamic properties, calculate energy/enthalpy required for a particular application (boilers, heat exchangers, etc).
4. Use real / ideal gas equations/ charts/tables to calculate change in properties of the systems in case of single fluid and mixture of fluids.

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.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	1	1	3	1	2	2	3	1	1	1
2	3	2	3	--	1	2	--	1	3	2	3	2
3	1	1	2	1	1	3	--	1	2	2	3	1
4	3	2	3	2	3	1	2	--	3	1	2	1

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 314 C	Strength of Materials	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs
Simple stress and strain: Introduction, stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation – behavior in Tension for Mild steel and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position. **Stress in composite section:** Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).	
UNIT – II	**10 Hrs**
Compound stresses: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle (introduction). **Thick and thin cylinders:** Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation), (compound cylinders not included).	
UNIT – III	**10 Hrs**
Bending moment and Shear force in beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniform distributed load (udl) and couple for different types of beams. **Bending and shear stresses in beams:** Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses and radius of curvature, relationship between bending moment and radius of curvature, shear streses, symmetrical I and T sections.	
UNIT – IV	**10 Hrs**
Deflection of beams: Introduction, differential equation for deflection, equations for deflections-Cantilever subjected to concentrated load at free end,udl,simply supported beam subjected to point load at mid-span.UDL. **Torsion of circular shafts and Elastic stability of columns:** Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts. **Introduction to columns:** Euler's theory for axially loaded elastic long columns, derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.	

Reference Books:

1. "Strength of Materials", S.S.Bhavikatti, Vikas publications House – Pvt. Ltd., 2nd Ed., 2006.
2. "Mechanics of materials" K.V. Rao, G.C. Raju, First Edition,2007
3. "Engineering Mechanics of Solids" Egor.P. Popov, Pearson Edu. India, 2nd, Edition,1998.
4. "Mechanics of Solids", Mubeen, Pearson Edu. India, 2002
5. "Strength of Materials", W.A. Nash, Sehaum's Outline Series, Fourth Edition-2007.
6. "Mechanics of Materials" by R. C. Hibbeler, Printice Hall, Pearson Edu., 2005
7. "Mechanics of materials" James M. Gere, Thomson, Fifth edition 2004
8. "Mechanics of materials" Ferdinand Beer & Russell Johnstan, TATA MaGrawHill-2003
9. "Mechanics of Materials" Ansel C. Ugural, Page Turners 2013

Course Outcomes:

At the end of the course, the students will be able to:

1. To be able to understand the different types of physical loads, properties of the materials, such as stresses, strains, elasticity, deformation for varying cross section, compound bars, self-weight and thermal stresses.
2. Analyze the compound stresses analytically ,and graphically and cylinders exposed to internal and external pressures from the view point of stresses developed and change in their dimensions.
3. To be able to understand the shear force and bending moment and estimate bending of beams of subjected to different loads with different end conditions of beams. Analyze the bending and shear stresses for different cross sections.
4. To be able to understand the concept torque, stresses developed and the rigidity of the mechanical elements transmitting power or subjected to twisting moment columns with different end conditions subjected to axial loading.

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.

Table: Matrix to describe the mapping of POs with COs

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P10	P11	P12
1	2	1	--	2	--	--	--	--	--	--	--	3
2	2	3	1	1	--	2	1	3	3	3	2	--
3	2	3	1	1	--	2	1	2	3	3	2	--
4	1	--	--	---	2	1	2	3	3	1	2	3

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 316 C	Theory of Machines	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs
Introduction: DEFINITIONS: Link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine. kinematic chains and inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain. **MECHANISMS:** Quick return motion mechanisms -Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms – Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms – Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.	
UNIT – II	**10 Hrs**
STATIC FORCE ANALYSIS: Introduction: Static Equilibrium. Equilibrium of Two and Three Force Members. Members with Two Forces and Torque, Free Body Diagrams, Principle of Virtual Work. Static Force Analysis of Four Bar Mechanism and Slider-Crank Mechanism with and without friction. **BALANCING OF ROTATING MASS:** Static and Dynamic Balancing, Balancing of Single Rotating Mass by Balancing Masses in Same plane and in Different planes. Balancing of Several Rotating Masses by Balancing Masses in Same plane and in Different planes.	
UNIT – III	**10 Hrs**
GOVERNORS: Types of Governors: Force Analysis of Porter and Hartnell Governors. Controlling Force,Stability,Sensitiveness,Isochronism,Effort and Power **GYROSCOPE:** Vectorial Representation of Angular Motion, Gyroscopic Couple. Effect of Gyroscopic Couple on Ship, Plane Disc, Aeroplane, Stability of Two Wheelers and Four Wheelers.	
UNIT – IV	**10 Hrs**
GEAR TRAINS: Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains. **CAMS:** Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife -edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.	

Reference Books:

1. Shigley. J. V. and Uickers, J.J., "Theory of Machines & Mechanisms" OXFORD University press.2004
2. "Theory of Machines -I", by A.S.Ravindra, Sudha Publications, Revised 5th Edi. 2004.
3. "Rattan S.S, "Theory of Machines" Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2nd edition – 2005.
4. Sadhu Singh, "Theory of Machines," Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2nd Edi. 2006.

Course Outcomes:

At the end of the course, the students will be able to:

1. Construct/Compose mechanisms to provide specific motion.
2. To understand forces acting on the mechanisms.
3. To analyze the effect of a gyroscopic couple on Ship, Aeroplan and an Automobile.
4. To understand gears & gear trains and construct cam profile for the specific follower motion.

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.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	3	3	3	3	3	--	3	2	--	3
2	3	3	3	3	3	2	3	--	3	2	--	3
3	3	3	3	3	3	3	3	--	3	--	--	3
4	3	3	3	3	3	3	2	--	2	--	--	3

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

COMMON TO ALL BRANCHES

UME 307 L	**Material Science and Material Testing Laboratory**	**01 - Credit (0 : 0 : 2)**
Hrs/Week : 02		CIE Marks : 50
Total Hours: 30		SEE Marks : 50

LIST OF EXPERIMENTS

PART – A

1. Impact Test (Charpy)
2. Impact Test (Izod)
3. Brinnell Hardness Test
4. Vickers Hardness Test
5. Rockwell Hardness Test

PART - B

1. Tensile test using UTM
2. Compression Test using UTM
3. Bending Test using UTM
4. Shear Test using UTM
5. Preparation of samples for micro structural analysis (Demonstration)

* All test as per ASTM standards

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.

Course Outcomes:

1. Understand the importance of ductile and brittle metals in determining the toughness
2. Recognize how the hardness varies with load and indentor
3. Analysis of how Pascal's law is used to apply heavy load to the specimen using UTM
4. Identify the type of failure of wood and stainless steel using UTM Understanding the basic definitions of stress, strain, UTS, % of E. Identifying the types of etchants for various metals and its alloys.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	2	1	3	1	2	2	3	2	1	--
2	3	2	2	1	1	2	2	1	3	2	3	2
3	1	1	2	1	1	3	--	1	2	2	3	1
4	3	2	3	2	2	1	3	--	3	1	2	--

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

COMMON TO ALL BRANCHES

UME 310 L	Mechanical Drawing Laboratory	01 - Credit (0 : 0 : 2)
Hrs/Week : 02		CIE Marks : 50
Total Hours: 30		SEE Marks : 50

LIST OF EXPERIMENTS

PART – A

Drafting overview

1. Scales (Enlarging and Reducing BIS Code of engineering)
2. Dimensioning and tolerance
3. Surface finish
4. Conventions, abbreviations and symbols
5. Orthographic conversion (Miscellaneous Problems)
6. Component drawing reading 3 examples

PART - B

Assembly

1. Valves (Any two), using drafter
2. Free hand sketching of the following
3. Valve gear mechanism
4. Automobile parts- Carburetor, Fuel pump, differential, power transmission, steering system, braking system, Clutches, Gear Box

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.

Course Outcomes:

1. Proficient in using engineering drawing instruments, materials and techniques.
2. Draw orthographic projections.
3. Conventions used in engineering drawing.
4. Visualization skills so that they can apply them in developing new products.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
1	1	2	--	2	--	--	--	--	--	--	--	1
2	2	1	1	1	--	2	2	3	1	3	2	1
3	1	2	1	1	--	2	1	2	2	3	1	
4	1	--	--	--	2	1	1	3	1	1	2	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

COMMON TO ALL BRANCHES

UME 308 L	Foundry and Forging Laboratory	01 - Credit (0 : 0 : 2)
Hrs/Week : 02		CIE Marks : 50
Total Hours: 30		SEE Marks : 50

LIST OF EXPERIMENTS

Part – A

1. Testing of Molding sand and Cores and Preparation of sand specimens and conduction of the following tests:
2. Compression, Shear and Tensile tests on Universal Sand Testing Machine.
3. Permeability test
4. Core hardness &Mould hardness tests.
5. Grain fineness number test (Sieve Analysis test)
6. Clay content test.
7. Moisture content test.
8. Shatter index

PART B

2. Foundry Practice

Use of foundry tools and other equipments. Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes). Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART C

3. Forging Operations

Preparing minimum three forged models involving upsetting, drawing and bending operations. Estimation of length of the raw material. Out of these three models, at least one model is to be prepared by using Power Hammer.

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.

Course Outcomes:

Students will be able to

1. Demonstrate various skills of sand preparation, molding.
2. Demonstrate various skills of forging operations.
3. Work as a team keeping up ethical principles.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	--	--	3	1	2	2	3	--	1	--
2	3	2	3	--	1	2	--	1	3	2	3	2
3	1	1	2	1	1	3	--	1	2	2	3	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

COMMON TO ALL BRANCHES

UMA 330 L	**Bridge Course Mathematics - I**	**03 - Credit (3 : 0 : 0)**
Hrs/Week : 03		CIE Marks : 50
Total Hours: 30		SEE Marks : 50

UNIT – I	**10 Hrs**
Differential Calculus: Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Taylor's and Maclaurin's series expansions for one variable (statements only)without proof. problems	
UNIT – II	**05 Hrs**
Partial differentiation: Introduction to function of several variables, Partial derivatives; Euler's theorem - problems. Total derivatives-differentiation of composite functions. Jacobians-problems,	
UNIT – III	**10 Hrs**
Integral Calculus: Reduction formula $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$ and $\int \sin^n x \cos^n x dx$. Evaluation of double and triple integrals. Area bounded by the curve. **Beta and Gamma functions:** Definitions, Relation between beta and gamma functions- problems	
UNIT – IV	**05 Hrs**
Vector Calculus: Vector Differentiation: Scalar and vector fields. Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields- problems	

Course Outcomes:

1. Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.
2. Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.
3. Apply the concept of multiple integrals and their usage in computing the area and volumes.
4. Apply the knowledge of vector calculus to solve the engineering problems

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1									
2	3	2	2									
3	3	2	2									
4	3	2	2									
5	3	2	1									

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

COMMON TO ALL BRANCHES

UBT133M	Environmental Studies	00 - Credit (2 : 0 : 0)
Hrs/Week : 03		CIE Marks : 50
Total Hours: 30		SEE Marks : 50

UNIT – I	07 Hrs

Environment & Ecology: Environmental segments, Ecosystem and classification of ecosystem. Environmental Impacts of human activities : Agriculture, Transportation, Industry, Mining, Urbanization.

Natural Resources: Forest, water, mineral, food, land resources and biodiversity,

Renewable Energy: Solar energy, wind energy, Hydropower, Tidal energy, Ocean thermal energy, Geo thermal energy, Biomass energy, Biogas, Biofuels, Hydrogen as fuel.

Non renewable Energy: Coal, Petroleum, Natural gas, Nuclear energy.

UNIT – II	07 Hrs

Environmental Pollution: Water pollution, water quality standards, water borne diseases, Fluoride problem, Air pollution, Noise pollution. Effect of electromagnetic waves.

Sustainable future : Concept of sustainable development, threats to sustainability, over exploitation of resources, strategies for sustainable development. Environment education, conservation of resources. Environment economics – concept of green building, clean development mechanism (CDM).

UNIT – III	06 Hrs

Current Environmental Issues of concern: Population growth, Greenhouse Effect- Greenhouse gases and Global Warming, Climate change, ozone layer depletion, Acid rain, Eutrophication

Environmental policy legislation rules & regulations : National environmental policy, environment protection act, legal aspects of air & water act. Functions of Government agencies.

UNIT – IV	06 Hrs

Fundamentals of Waste management: Solid waste management: Sources, classification, characteristics, collection & transportation, disposal, and processing methods. Hazardous waste management and handling. Concept of waste water treatment , Bioremediation. Industrial waste management (Case studies: Cement, plastic, chemical, E–waste, food & construction industry waste management).

Reference Books:

1. Benny Joseph “Environmental Studies” Tata McGraw Hill, 2005.
2. Dr. D. L. Manjunath, “Environmental Studies” Pearson Education, 2006
3. Koushik and Koushik “Environmental Science & Engineering” New Age International Publishers, New Delhi, 2006
4. P. Venugopal Rao “Principles of Environmental Science & Engineering” Pranticce Hall of India, 2006.
5. Meenakshi “Environmental Science & Engineering” ” Pranticce Hall of India, 2006.
6. S. K. Garg “Environmental Science & Ecological Studies” Khanna Publishers New Delhi, 2007.
7. P.D.Sharma “Ecology and Environment” Rastogi Publications, 2012

Course Outcomes:

1. Ability to understand basic aspects of environment
2. Ability to understand impacts of human activities on nature

3. Ability to know about natural resources
4. Ability to understand the pollution and its effects on nature.
5. Ability to understand the concept of sustainable development
6. Ability to know about acts regarding environmental protection

Course Outcomes	Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO 1	-	-	-	-	-	1	3	-	-	-	-	3
CO 2	-	1	-	-	-	2	3	-	-	-	-	3
CO 3	2	-	-	-	-	-	3	-	-	-	-	3
CO 4	-	2	-	-	-	2	2	-	-	-	-	3
CO 5	-	-	-	1	-	2	2	1	-		-	3
CO 6	3	-	2	2	-	-	2	-	-	-	-	3

BVVS

UHS389C/UHS489C	**Adalita Kannada (AK) / Vyavaharika Kannada (VK)**	**1 Credits (2:0:)**
Hrs/Week : 02		CIE Marks : 50
Total Hours: 26		SEE Marks : 50

10 Hrs

Balake Kannada

Unit – I

Listening and Hearing **06 Hrs**

Introduction: Activity -I

- Easy learning of a Kannada Language: A few tips
- Necessity of learning a local language:
- Tips to learn the language with easy methods.
- Hints for correct and polite conservation
- About Kannada Language (Kannada Bhashe)
- Eight Kannada authors who have won 'Jnanpith Award'
- Information about Karnataka State

KelisikolluvudumattuAlisuvudu: Activity -II

Listening to Kannada words and Sentences through different types of communications of day to day affairs. [Conversations in Kannada – Kannada BhasheyalliSambhashanegalu]

Conversation with

- With Friends – Snehitharodane-(¸ÉßÃ»vÀgÉÆqÀ£É)
- With Teachers- (UÀÄgÀÄUÀ¼ÉÆqÀ£É)
- In Shop, Market, Bus and Train(CAUÀr, ªÀiÁgÀÄPÀmÉÖ, §¸ï, gÉÊ®Ä)
- In Hotel / Canteen(ºÉÆmÉ¯ï/PÁåAnÃ£ï£À°è)
- With Dependents**(**CªÀ®A©vÀgÉÆqÀ£É)
- In Hostel with Friends, Warden, Cooks and Security(ºÁ¸ÉÖ¯ï£À°è)
- Vocabulary - Shabdakosha–±À§ÝPÉÆÃ±À
- Conversation - Sambhashane- ¸ÀA¨sÁµÀuÉ- 1 (about City)
- Conversation - Sambhashane-¸ÀA¨sÁµÀuÉ-2(between Friends)
- Excersises to test their knowledge of understanding the Language.

Conversation with Teacher, House Owner and Roommate

- Vocabulary - Shabdakosha –±À§ÝPÉÆÃ±À
- Conversation - Sambhashane-¸ÀA¨sÁµÀuÉ- 1 (with Teacher)
- Conversation-Sambhashane-¸ÀA¨sÁµÀuÉ-2(With House Owner)
- Conversation-Sambhashane-¸ÀA¨sÁµÀuÉ- 3 (with Roommate)
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation

Activity - III - Conversation with

- Vocabulary - Shabdakosha –±À§ÝPÉÆÃ±À
- Conversation - Sambhashane-¸ÀA¨sÁµÀuÉ-1 (with Teacher)
- Conversation-Sambhashane-¸ÀA¨sÁµÀuÉ-2 (with House Owner)
- Conversation-Sambhashane-¸ÀA¨sÁµÀuÉ-3 (with Roommate)
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation

Activity - IV - Conversation with

- Vocabulary - Shabdakosha –±À§ÝPÉÆÃ±À
- Conversation - Sambhashane-¸ÀA¨sÁµÀuÉ-1 (with Teacher)
- Conversation-Sambhashane-¸ÀA¨sÁµÀuÉ-2 (with House Owner)
- Conversation-Sambhashane-¸ÀA¨sÁµÀuÉ-3 (with Roommate)
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation

Unit – II

Speaking and Asking
06Hrs
Maatanaadhuvudumattu Keluvudu –
ಮಾತನಾಡುವುದುಮತ್ತುಕೇಳುವುದು

[Kannada Words and Sentenses in Conversation - Sambhashaneyalli Kannadada Padagalu mattu Vakyagalu - ¸ÀA¨sÁµÀuÉAiÀÄ°èPÀ£ÀßqÀzÀ ¥ÀzÀUÀ¼ÀÄ ªÀÄvÀÄÛ ªÁPÀåUÀ¼ÀÄ]

In Speaking / Asking -Sambhashaneyalli-¸ÀA¨sÁµÀuÉAiÀÄ°è

- Nouns - Naamapadagalu- £ÁªÀÄ¥ÀzÀUÀ¼ÀÄ
- Pronouns – Sarvanamapadagalu- ¸ÀªÀð£ÁªÀÄ¥ÀzÀUÀ¼ÀÄ
- Adjectives – namavisheshanagalu - £ÁªÀÄ «±ÉÃµÀtUÀ¼ÀÄ
- Verbs- Kriyapadagalu- QæAiÀiÁ¥ÀzÀUÀ¼ÀÄ
- Adverbs - kriya visheshanagalu–QæAiÀiÁ «±ÉÃµÀtUÀ¼ÀÄ
- Conjunctions - Samyogagalu–¸ÀAAiÉÆÃUÀUÀ¼ÀÄ
- Prepositions - Upasarga– G¥À¸ÀUÀðUÀ¼ÀÄ
- Interrogative words and Sentences in Conversation – Sambhashaneyalli Prashnarthaka padagalu mattu vakyagalu-¥Àæ±ÁßxÀðPÀ ¥ÀzÀUÀ¼ÀÄ ªÀÄvÀÄÛ ªÁPÀåUÀ¼ÀÄ
- Vicharaneya/ Vicharisuva / Bedikeyavakyagalu (Enquiry / Request sentences in Conversation) - «ZÁgÀuÉAiÀÄ / «ZÁj¸ÀÄªÀ / ¨ÉÃrPÉAiÀÄ ªÁPÀåUÀ¼ÀÄ
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation.

UNIT III

Reading – Ooduvudu – NzÀÄªÀÅzÀÄ
07Hrs

Kannada Wards and Sentenses in General Reading and Conversation-Samanya Sambhashaneyalli Kannadada Padagalu mattu Vakyagalu -

¸ÀA¨sÁµÀuÉAiÀÄ°èPÀ£ÀßqÀzÀ ¥ÀzÀUÀ¼ÀÄ ªÀÄvÀÄÛ ªÁPÀåUÀ¼ÀÄ)

- Singular and Plural nouns in Conversation- SambhashaneyalliEkaavachana mattu Bhahuvachana - JPÀªÀZÀ£À ªÀÄvÀÄÛ §ºÀÄªÀZÀ£À
- Gender in Conversation - Sambhashaneyalli Linga- °AUÀ
- Viruddhapadagalu /Virodarthakapadagalu (Antonyms)– «gÀÄzÀÝ / «gÉÆÃzÁxÀðPÀ ¥ÀzÀUÀ¼ÀÄ.
- AsamanjasaUchcharane (Inappropriate Pronounciation) – C¸ÀªÀÄAd¸ÀGZÁÑgÀuÉ
- SankhyaVyavasthe (Numbers system)- ¸ÀASÁå ªÀåªÀ¸ÉÜ
- Bhinnamshagalu (Fractions) –©ü£ÁßA±ÀUÀ¼ÀÄ
- TindiyaHesarugalu/ BelaginaupaharagalaHesarugalu - Menu (Names) of the breakfast Items –wArAiÀÄ ºÉ¸ÀgÀÄUÀ¼ÀÄ
- Aaharakkesambandhisidapadagalu / AaharapadarthagalaHesarugalu– (Names connected with food) –DºÁgÀPÉÌ ¸ÀA§A¢¹zÀ ¥ÀzÀUÀ¼ÀÄ.
- Samaya / KalakkeSambhandhisidapadhagalu (Words Relating to Time)– ¸ÀªÀÄAiÀÄ / PÁ®PÉÌ ¸ÀA§A¢ü¹zÀAvÀºÀ ¥ÀzÀUÀ¼ÀÄ
- Dikkugaligesambhadisidapadhagalu (Words Relating to Directions) – ¢QÌUÉ ¸ÀA§A¢ü¹zÀAvÀºÀ ¥ÀzÀUÀ¼ÀÄ
- ManavanaBhavanegaligesambandisidaPadagalu (Words Relating to Human's feelings and Emotions) –ªÀiÁ£ÀªÀ£À ¨sÁªÀ£ÉUÀ½UÉ ¸ÀA§A¢ü¹zÀ ¥ÀzÀUÀ¼ÀÄ
- Manavanashareeradabhagagalu / Angagalu (Parts of the Human body)- ªÀiÁ£ÀªÀ£À ±ÀjÃgÀzÀ ¨sÁUÀUÀ¼ÀÄ / CAUÀUÀ¼ÀÄ
- ManavaSambhandhada / Sambhandhaakkesambhadisidapadhagalu (Terms Relating to Human Relationship)- ªÀiÁ£ÀªÀÀ ¸ÀA§AzÀPÉÌ ¸ÀA§A¢ü¹zÀAvÀºÀ ¥ÀzÀUÀ¼ÀÄ
- Vaasadasstalakkesambhandisidanthahapadhagalu (Words Relating to Place of Living) -ªÁ¸ÀzÀ ¸ÀÜ¼ÀPÉÌ ¸ÀA§A¢¹zÀAvÀºÀ ¥ÀzÀUÀ¼ÀÄ
- Saamanya Sambhashaneyalli Bhalasuvanthaha Padagala Patti (List of Words, used in the general conversation) – ¸ÁªÀiÁ£Åå ¸ÀA¨sÁµÀuÉAiÀÄ°è §¼À¸ÀÄªÀAvÀºÀ ¥ÀzÀUÀ¼À ¥ÀnÖ
- Additional Excersises to test their knowledge of understanding the Kannada words and sentences in their communication.

UNIT IV

Writing – Bareyuvudu – §gÉAiÀÄÄªÀÅzÀÄ07Hrs

Kannada Alphabets and their Pronunciation –
Kannada AksharaMale mattu uchcharane –
PÀ£ÀßqÀ CPÀëgÀªÀiÁ¯É ºÁUÀÆ GZÁÑgÀuÉ PÀ£ÀßqÀ CPÀëgÁ¨sÁå¸À

- Kannada Aksharamale(PÀ£ÀßqÀ CPÀëgÀªÀiÁ¯É)
- Kannada stress letters - vattakshara (also often written as Ottakashara)
- Kannada khaghunitha (Pronounced as ka-gunitha)
- Excersises to test their knowledge of understanding the Kannada words.
- Pronunciation (Uchcharane), Memorisation and usage of the Kannada Letters
- VargeeyaVyanjanagalaUchcharane (Pronounciation of Structured

BVVS

Consonants) AvargeeyaVyanjanagalaUchcharane (Pronounciation of Unstructured Consonants) Excersises to test their knowledge of understanding the Kannada words.

- Excersises to test their knowledge of understanding the Kannada alphabets.
- Additional Excersises to test their knowledge of understanding the Kannada alphabets.

ಒಟ್ಟು: 26 ಗಂಟೆಗಳು

¥ÀoÀå¥ÀÄ¸ÀÛPÀ:

§¼ÀPÉ PÀ£ÀßqÀ (¸ÀA), qÁ.J¯ï.wªÉÄäÃ±À, ¥ÉÆæ. «.
PÉÃ±ÀªÀªÀÄÆwð,Prasarang, VTU, Belagavi, Karnataka 2020.

Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	--	--	--	--	--	--	--	2	--	--
CO2	1	2	--	--	--	--	--	--	--	2	--	--
CO3	1	2	--	--	--	--	--	--	--	3	--	--
CO4	1	--	---	--	--	--	--	--	--	2	--	--
CO5	1	--	--	--	---	--	--	--	--	2	--	--
CO6										1		

UHS389C/UHS489C	SAMSKRUTIKA KANNADA (AU,BT,CV,IP,ME,CS,EC,EE,EI,IS,AIML BRANCHES)	1 Credits (2:0: 0)
Hrs/Week : 02		CIE Marks : 50
Total Hours: 26		SEE Marks : 50

	10 Hrs

¨sÁUÀ: I PÀ£ÀßqÀ £ÁqÀÄ, £ÀÄr, ¸ÀA¸ÀÌøw ªÀÄvÀÄÛ ªÀåQÛavÀæt

CªÀ¢ü: 6 UÀAmÉ

1. PÀ£ÁðlPÀ ¸ÀA¸ÀÌøw - ºÀA¥À £ÁUÀgÁdAiÀÄå
2. PÀ£ÁðlPÀKQÃPÀgÀt :MAzÀÄC¥ÀÆªÀðZÀjvÉæ– f.ªÉAPÀl¸ÀÄ§âAiÀÄå
3. PÀ£ÀßqÀ ¨sÁµÉ ªÀÄvÀÄÛPÀ£ÁðlPÀ ¸ÀA¸ÀÌøw– «vÁ«
4. qÁ.¸Àgï.JA.«±ÉéÃ±ÀégÀAiÀÄå : ªÀåQÛ ªÀÄvÀÄÛLwºÀå– J.J£ï.ªÀÄÆwðgÁªï

¨sÁUÀ: IIPÀxÉ, ¥ÀæªÁ¸ÀPÀxÉ ªÀÄvÀÄÛPÀgÀPÀÄ±À® PÀ¯É

CªÀ¢ü: 6 UÀAmÉ

1. AiÀÄÄUÁ¢ - ªÀ¸ÀÄzsÉÃAzÀæ
2. ªÉÄUÁ£É JA§ Vjd£À ¥ÀªÀðvÀ - ». a. ¨ÉÆÃgÀ°AUÀAiÀÄå
3. PÀgÀPÀÄ±À® PÀ¯ÉUÀ¼ÀÄ ªÀÄvÀÄÛ ¥ÀgÀA¥ÀgÉAiÀÄ «eÁÕ£À–PÀjUËqÀ ©ÃZÀ£ÀºÀ½î

¨sÁUÀ: IIIPÁªÀå

CªÀ¢ü: 7UÀAmÉ

1. ªÀZÀ£ÀUÀ¼ÀÄ - §¸ÀªÀtÚ, C®èªÀÄ¥Àæ¨sÀÄ, CPÀÌªÀÄºÁzÉÃ«
2. QÃvÀð£ÉUÀ¼ÀÄ - ¥ÀÄgÀAzÀgÀzÁ¸ÀgÀÄ, PÀ£ÀPÀzÁ¸ÀgÀÄ
3. vÀvÀé¥ÀzÀUÀ¼ÀÄ - ²±ÀÄ£Á¼À ±ÀjÃ¥sÀgÀÄ, ¨Á®°Ã¯Á ªÀÄºÁAvÀ ²ªÀAiÉÆÃVUÀ¼ÀÄ
4. d£À¥ÀzÀVÃvÉ, 5. ªÀÄAPÀÄwªÀÄä£À PÀUÀÎ –r«f
6. ¨É¼ÀUÀÄ - CA©PÁvÀ£ÀAiÀÄzÀvÀÛ, 7.C¤PÉÃvÀ£À - PÀÄªÉA¥ÀÄ

¨sÁUÀ: IVPÁªÀå, «eÁÕ£À ªÀÄvÀÄÛvÀAvÀæeÁÕ£À

CªÀ¢ü: 7UÀAmÉ

PÁªÀå

1. ºÉAqÀwAiÀÄPÁUÀzÀ - PÉ.J¸ï.£ÀgÀ¹AºÀ¸Áé«Ä
2. ªÀÄÄA¨ÉÊ eÁvÀPÀ–f.J¸ï.²ªÀgÀÄzÀæ¥Àà
3. D ªÀÄgÀ F ªÀÄgÀ–ZÀAzÀæ±ÉÃRgÀPÀA¨ÁgÀ
4. ZÉÆÃªÀÄ£À ªÀÄPÀÌ¼À ºÁqÀÄ - ¹zÀÞ°AUÀAiÀÄå

«eÁÕ£À ªÀÄvÀÄÛvÀAvÀæeÁÕ£À

1. ‘PÀ’ ªÀÄvÀÄÛ ‘§’ §gÀºÀ vÀAvÁæA±ÀUÀ¼ÀÄ, PÀA¥ÀÆålgï ªÀÄÄSÁAvÀgÀPÀ£ÀßqÀzÀmÉÊ¦AUï
2. PÀ£ÀßqÀ PÀA¥ÀÆålgï ±À§ÞPÉÆÃ±À,
3. vÁAwæPÀ ¥ÀzÀPÉÆÃ±À

Total: L-26 Hours

¥ÀoÀå¥ÀÄ¸ÀÛPÀ:

¸ÁA¸ÀÌøwPÀ PÀ£ÀßqÀ (¸ÀA), qÁ. ».a.¨ÉÆÃgÀ°AUÀAiÀÄå, qÁ.J¯ï.wªÉÄäÃ±À, ¥ÉÆæ.«.PÉÃ±ÀªÀªÀÄÆwð, Prasaranga VTU, Belagavi, Karnataka, 2020.

ಕೋರ್ಸ್‌ಲಿತಾಂಶಗಳು:

At the end of the course the student should be able to:

«zÁåyðUÀ¼ÀÄ ¨Ë¢ÞPÀªÁV ¨É¼ÉAiÀÄÄªÀÅzÀgÉÆA¢UÉ £ÀªÀÄä £Ár£À ªÀÄvÀÄÛzÉÃ±ÀzÀ ¸ÁA¸ÀÌøwPÀ ªÁgÀ¸ÀÄzÁgÀgÁV ¨É¼ÉzÀÄ ¸ÁéªÀ®A©AiÀiÁV §zÀÄPÀÄ PÀnÖPÉÆ¼ÀÄîvÁÛgÉ PÀ£ÀßqÀ ¨sÁµÉAiÀÄ£ÀÄß ¸ÀªÀÄxÀðªÁ ªÀiÁvÀ£ÁqÀÄªÀÅzÀgÉÆA¢UÉ, C£ÀågÀ£ÀÄß CxÉÊð¹PÉÆ¼ÀÄî ªÀÄ£ÉÆÃ§® ¨É¼É¹PÉÆ¼ÀÄîvÁÛ£É. EªÀwÛ£À ¸ÀAQÃtðªÁz ¸ÁªÀiÁfPÀ ªÀåªÀ¸ÉÜAiÀÄ°è ¸ËºÁzÀðAiÀÄÄvÀªÁz £ÀqÀÄªÀ½PÉAiÉÆA¢UÉ ¸ÀA¥À£ÀÆä® ªÀåQÛAiÀiÁ gÀÆ¥ÀÄUÉÆ¼ÀÄîvÁÛ£É.

eÁUÀwPÀgÀtzÀEªÀwÛ£À ¸ÀAzÀ¨sÀðzÀ°è «zÁåyðUÀ¼À ¸ÀévÀAvÀæöªÁVD¯ÉÆÃa¸ÀÄªÀ, ¸ÀévÀAvÀæªÁV §gÉAiÀÄÄª ¸ÀévÀAvÀæªÁV aAvÀ£À²Ã®gÁUÀÄªÀ ¸ÁªÀÄxÀåðªÀ£ÀÄß ¥ÀqÉzÀ ¸ÀªÀÄAiÉÆÃavÀªÁV ¸ÀÆPÀÛ ¤zsÁðgÀUÀ¼À£ÀÁ PÉÊUÉÆ¼ÀÄîªÀ°è F CzsÀåAiÀÄ£À ¢Ã¥À¸ÀÜA§ªÁVzÉ.

«zÁåyðUÀ¼ÀÄ EA¢£À eÁUÀwPÀ «zÀåªÀiÁ£ÀUÀ¼À£ÀÄß CxÉÊð¹PÉÆAqÀÄ, ¸ÀªÀiÁdzÀ°è ¸ÀAWÀfÃ«AiÀiÁV ¨É¼ÉAiÀÄÄªÀ ªÀÄ£ÉÆÃ§®ªÀ£ÀÄß ªÀÄvÀÄÛDvÀä¸ÉÛöÊAiÀÄðªÀ£ÀÄßvÀÄA§ÄªÀ° F CzsÀåAiÀÄ£À ¸ÀÆPÀÛªÁzÀ ªÀiÁUÀðzÀ²ðPÉAiÀiÁVzÉ.

vÀ£Àß C¹ävÉAiÀÄ ºÀÄqÀÄPÁlzÀ°ègÀÄªÀ ªÀåQÛUÉ, CzÀÄ F £É®zÀ ¸Áé©üªÀiÁ£À, ¨sÁvÀÈvÀé, ¦æÃw, ¸ËºÁzÀðAiÀÄÄvÀªÁzÀ ªÀÄ£À¸ÀÄìUÀ¼À°è EzÉJA§ÄzÀ£ÀÄß «zÁåyðUÀ¼À CjvÀPÉÌvÀgÀÄvÀÛzÉ.

«zÁåyðUÀ¼À°è ¥Àj¸ÀgÀ ¥ÀæeÉÕAiÀÄ£ÀÄß eÁUÀÈvÀUÉÆ½¹, zÉÊªÀ¸ÀÈ¶ÖAiÀiÁzÀ F CªÀÄÆ®å ¸ÀA¥ÀvÀÛ£ÀÄß »vÀ-«ÄvÀªÁV §¼À¹PÉÆAqÀÄ ªÀÄÄA¢£À vÀ¯ÉªÀiÁjUÉCzÀ£ÀÄß §¼ÀÄªÀ½AiÀiÁV ©lÄÖºÉÆÃUÀÄªÀ°èeÁUÀÈvÀ£ÁUÀÄvÁÛ£É.

Course Outcomes	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	--	--	--	--	--	--	--	2	--	--
CO2	1	2	--	--	--	--	--	--	--	2	--	--
CO3	1	2	--	--	--	--	--	--	--	3	--	--
CO4	1	--	---	--	--	--	--	--	--	2	--	--

CO5	1	--	--	--	---	--	--	--	--	2	--	--
CO6										1		

4th Semester Syllabus

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

Department of Mechanical Engineering

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

B.E. IV *SEMESTER*

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1.	UMA429C	Complex Analysis and Statistics	3	2	2	-	50	50	100
2.	UME 415C	Applied Thermodynamics	3	2	2	-	50	50	100
3.	UME 416C	Metrology & Instrumentation	3	3	-	-	50	50	100
4.	UME 417 C	Machining and Machine Tools	3	3	-	-	50	50	100
5.	UME 418C	Fluid Mechanics	3	2	2	-	50	50	100
6.	UHS 001N	Fundamentals of Quantitative Aptitude and Soft Skills	1	2	-	-	50	50	100
7.	UME 407L	Metrology & Instrumentation Lab	1	-	-	2	50	50	100
8.	UME 408L	Machine Shop Lab	1	-	-	2	50	50	100
9.	UME 421L	CAMD Lab	2	1	-	2	50	50	100
10.	UHS004M	Universal Human Values – II	0	3	-	-	50	50	100
11.	UMA 430M	**Bridge Course Mathematics-II	0	3	-	-	50	50	100
		Total Credits :	**20**	**21**	**06**	**06**	**550**	**550**	**1100**

****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.

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UMA 429 C	**Complex Analysis and Statistics**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**

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

UNIT – II	**10 Hrs**

Complex Integration: 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	**10 Hrs**

Statistics and Probability: 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	**10 Hrs**

Probability distributions: 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.

Reference Books:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Advanced Engineering Mathematics by Peter V. O'Neil.

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

1. To attempt solve real world problems using complex variable techniques
2. To use the concept of complex integration technique's for solving engineering problems
3. To understand the concepts of curve fitting and probability.
4. To understand the concepts of probability distributions
5. To understand the concepts of probability distributions

Question paper pattern:

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.

Course Outcomes	Programme Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	--	--	--	--	--	--	--	--	--	--
CO2	1	2	--	--	--	--	--	--	--	--	--	--
CO3	1	2	--	--	--	--	--	--	--	--	--	--
CO4	1	--	---	--	--	--	--	--	--	--	--	--
CO5	1	--	--	--	---	--	--	--	--	--	--	--

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 415 C	APPLIED THERMODYNAMICS	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	12 Hrs
Gas Power Cycles: 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:** 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	**12 Hrs**
Gas Turbines: Methods to improve thermal efficiency- regeneration, inter cooling, reheating, their PV, TS diagram, description / process. **Vapor Power Cycles(simple/Ideal)** : 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	**14 Hrs**
Reciprocating Compressors: 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:** 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	**14 Hrs**
Psychometrics: 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**.	

Reference Books:

1. Thermodynamics –AEngineering Approach by Yunus, A.Cenegal and Michael A.Boles, Tata McGraw Hill Pub.
2. Co., 2002
3. Fundamental of Classical Thermodynamics by G.J. Van Wylen and R.E.Sonntag, WileyEastern.
4. A Course in I.C.Engines by M. L Mathur, R.P. Sharma, DhanpatRai& Sons any edition
5. Applied Thermodynamics by B.K.Venkanna and Swati BWadawadagi, PHI, New Delhi.
6. Internal Combustion Engines by V. Ganesan, Tata McGrawHIll, 2nd Edition or any Edition.

Course Outcomes:

1. 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.
2. 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.
3. 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.
4. 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 for SEE:

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.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	1	1	3	1	2	2	3	1	1	1
2	3	2	3	--	1	2	--	1	3	2	3	2
3	1	1	2	1	1	3	--	1	2	2	3	1
4	3	2	3	2	3	1	2	--	3	1	2	1

UME 416 C	**METROLOGY AND INSTRUMENTATION**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**

STANDARDS OF MEASUREMENT:
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	**10 Hrs**

COMPARATORS AND ANGULAR MEASUREMENT: 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	**10 Hrs**

MEASUREMENTS AND MEASUREMENT SYSTEMS: 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	**10 Hrs**

MEASUREMENT OF FORCE AND TORQUE, PRESSURE: 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.

Reference Books:

1. "Engineering Metrology" - I.C.Gupta, Dhanpat Rai Publications, Delhi
2. "Mechanical measurements" - R.K.Jain
3. "Industrial Instrumentation" - Alsutko, Jerry. D.Faulk, Thompson Asia Pvt. Ltd.2002
4. "Measurement Systems Applications and Design" - Ernest O, Doeblin, McGRAW Hill Book Co.
5. "Mechanical measurements" - Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006
6. "Engineering Metrology" - R.K.Jain, Khanna Publishers, 1994.

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

1. *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.
2. *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.
3. 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.
4. *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 for SEE:

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.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	2	1	3	1	2	2	3	2	1	--
2	3	2	2	1	1	2	2	1	3	2	3	2
3	1	1	2	1	1	3	--	1	2	2	3	1
4	3	2	3	2	2	1	3	--	3	1	2	--

UME 417 C	**MACHINING AND MACHINE TOOLS**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Theory of Metal Cutting: 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	**10 Hrs**
Turning, Shaping and Planing Machines: 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	**10 Hrs**
Milling Machines: 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	**10 Hrs**
Grinding Machines: 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.	

Reference Books:

1. Manufacturing Science by Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. Machining Technology: Machine Tools and Operations BY by Helmi A. Youssef & Hassan El-Hofy Visit the Taylor & Francis Web site at http://www.taylorandfrancis.com and the CRC Press Web site at http://www.crcpress.com
3. Workshop Technology by Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
4. Production Technology by R.K.Jain, Khanna Publications, 2003
5. Production technology by HMT, Tata MacGraw Hill, 2001.
6. Fundamentals of Metal Machining and Machine Tools by Second Edition Geoffrey Boothroyd Winston A. Knight ,University of Rhode IslandKingston, Rhode IslandMcGraw Hill, 2000.

Course Outcomes:

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

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

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 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.

Table: Matrix to describe the mapping of POs with COs

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1	1	1	3	1	2	2	3	1	1	1
2	3	2	2	--	1	2	--	1	3	2	3	2
3	1	1	1	1	1	3	--	1	2	2	3	1
4	2	2	2	2	3	1	2	--	3	1	2	1

UME 418 C	FLUID MECHANICS	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

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

Fluid Statics: 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	10 Hrs

Fluid Kinematics: 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: 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	10 Hrs

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

Flow through pipes: 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	10 Hrs

Laminar flow and viscous effects: 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: 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: 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

Reference Books:

1. Fluid Mechanics by OijushK.Kundu, IramCochen, Elsevier 3rd Edition. 2005.
2. Fluid Mechanics by John F.Douglas, Janul and M.Gasiosek and john A. Swaffield, Pearson Education Asia, 5th edition., 2006
3. Fluid Mechanics and Fluid Power Engineering," Kumar.D.SKataria and Sons.,2004.
4. Essential Computational Fluid Dynamics by Oleg ZiaanovPub:Jhon Wiley
5. Fluid Mechanics (SI Units), Yunus A. Cingel John M. Oimbala. Tata McGraw-Hill, 2006.
6. Fluid Mechanics by Dr. Bansal.R.K, Lakshmi Publications, 2004.
7. Fluid Mechanics and hydraulics, Dr. Jagadishlal: Metropolitan Book Co-Ltd., 1997.

Course Outcomes:

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

1. *Apply* the knowledge of fluid mechanics in selecting the types of fluids required for various engineering applications.
2. *Apply* the knowledge of fluid mechanics to *analyze* the fluid engineering problems by the method of dimensional analysis.
3. *Apply* the knowledge of fluid mechanics to *analyze* the fluid flow problems.
4. *Apply* the knowledge of fluid mechanics to *analyze* viscous and compressible fluid flow problems

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 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.

Table: Matrix to describe the mapping of POs with COs

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
1	3	2	1	1	1	2	1	3	3	1	1	2
2	3	2	1	1	1	2	1	3	3	1	1	2
3	3	2	1	1	1	2	1	3	3	1	1	2
4	3	2	1	1	1	2	1	3	3	1	1	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UHS 001 N	**Fundamentals of Quantitative Aptitude and Soft Skill**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Communication Skills & Vocabulary Development: Communication Tools, Active Listening, Non-Verbal Communication, Vocabulary Building Techniques, Root Words.	
UNIT – II	**10 Hrs**
Spoken English, English Language Structure& Number Theory: Introduction to IPA, Sounds in English, Grammar and Bouncing, Number System	
UNIT – III	**10 Hrs**
Presentation Skills &Linear Equations: Presentation Basics, Drills, Captivating the Audience, The God of Math	
UNIT – IV	**10 Hrs**
Factors and Multiples & Verbal and Visual Reasoning: HCF, LCM, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars, Visual Reasoning	

REFERENCE BOOKS:

1. R. S. Aggarwal, “A Modern Approach to Verbal and Non – Verbal Reasoning”, Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, “Quantitative Aptitude”, Sultan Chand and Sons, New Delhi, 2018
3. Chopra, “Verbal and Non – Verbal Reasoning”, MacMillan India
4. M. Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. Booher Diana, “Communicate with Confidence”, Booher Research Institute, 2011.

Course Outcomes: After active participation in this course, the student will have

1. learned the importance of non-verbal communication
2. understood the various sounds in the English Language
3. enhanced his/her vocabulary and learnt techniques to augment it further
4. understood analysis of the given problem and learnt to develop a method for solving it

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	--		--	--	--	--	--	--	--	3	--	1
CO2	--		--	--	--	--	--	--	--	2	--	1
CO3	--	3	--	--	--	--	--	--	--	--	--	2
CO4	--	3	--	--	--	--	--	--	--	--	--	2

UME 407 L	Metrology & Instrumentation Laboratory	01 - Credit (0 : 0 : 2)
Hrs/Week : 02		CIE Marks : 50
Total Hours: 30		SEE Marks : 50

LIST OF EXPERIMENTS

Part – A
INSTRUMENTATION

1. Calibration of Pressure Gauge
2. Calibration of Torque sensor
3. Calibration of LVDT
4. Calibration of Load cell
5. Calibration of micrometer using slip gauges
6. Calibration of speed sensor

PART-B:
METROLOGY

7. Measurements of angle using Sine Center / Sine bar / bevel protractor
8. Measurements of alignment using Autocollimator / roller set
9. Measurements of Screw thread Parameters using two wires or three-wire methods.
10. Measurements of gear tooth profile using gear tooth vernier /gear tooth micrometer.

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.

Course Outcomes: Students will be able to

1. Calibrate and analyse the characteristics of measuring instruments
2. Select suitable mechanical measuring instruments for basic and typical applications in the industries and analyse uncertainty in the measurements
3. Demonstrate the methods of measurement for various quantities like force, torque, power, displacement.
4. Illustrate the basic concepts of mechanical measurement and errors in measurements

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	2	1	3	1	2	2	3	2	1	--
2	3	2	3	1	1	2	2	1	3	2	3	2
3	1	1	2	1	1	3	--	1	2	2	3	1
4	3	2	3	2	3	1	2	--	3	1	2	--

UME 408 L	Machine Shop Laboratory	01 - Credit (0 : 0 : 2)
Hrs/Week : 02		CIE Marks : 50
Total Hours: 30		SEE Marks : 50

LIST OF EXPERIMENTS

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.

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

1. Demonstrate the operation of general purpose machine tools and manufacturing process.
2. Identify the special purpose machine tools for specific requirements.
3. CO3: Develop physical models using different manufacturing processes.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1	2	3	1	2	2	3	1	1	1
2	3	2	3	--	1	2	1	1	3	2	3	2
3	3	1	2	1	2	3	1	1	2	2	3	1

UME 411 L	Computer Aided Machine Drawing Laboratory	02 - Credit (1 : 0 : 2)
Hrs/Week : 02		CIE Marks : 50
Total Hours: 30		SEE Marks : 50

LIST OF EXPERIMENTS

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

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 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

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

1. To define basic sketching commands and navigational commands used in SOLID EDGE software

2. To understand conversion of pictorial views into orthographic projections of simple machine parts with or without section
3. To understand thread terminology, sectional views of threads, ISO Metric, BSW, square, Acme and Sellers thread, fasteners, joints and Couplings
4. 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

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
1	2	1	--	2	--	--	--	--	--	--	--	3
2	2	3	1	1	--	2	1	3	3	3	2	--
3	3	3	1	1	--	2	1	2	3	3	2	--
4	1	--	--	--	2	1	2	3	3	1	2	3

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

COMMON TO ALL BRANCHES

UMA 430 M	**Bridge Course Mathematics - II**	**03 - Credit (0 : 0 : 2)**
Hrs/Week : 03		CIE Marks : 50
Total Hours: 30		SEE Marks : 100

UNIT – I	**10 Hrs**
Ordinary differential equations of first order: 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.	
UNIT – II	**05 Hrs**
Laplace Transform: 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):** 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,	

Course Outcomes:

1. Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations.
2. Apply the Laplace transform techniques to solve differential equations.
3. Understand a variety of partial differential equations and solution by exact methods.
4. 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

Course Outcomes	**Programme Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	--	--	--	--	--	--	--	--	--	--
CO2	1	2	--	--	--	--	--	--	--	--	--	--
CO3	1	2	--	--	--	--	--	--	--	--	--	--
CO4	1	--	---	--	--	--	--	--	--	--	--	--
CO5	1	--	--	--	---	--	--	--	--	--	--	--

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UHS 004 M	**Universal Human Values – II**	**03 - Credits (3: 0: 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 100

UNIT – I	**10 Hrs**
Introduction to Value Education: Right Understanding;Relationship and Physical Facility;UnderstandingValue Education;Self-exploration as the Process for Value Education,Continuous Happiness and Prosperity -the Basic Human aspiration-Current Scenario and Method to Fulfill the Basic Human Aspirations.	
UNIT – II	**10 Hrs**
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self,Understanding Harmony in the Self, Harmony of the Self with the Body,Programme to ensure self-regulation and Health.	
UNIT – III	**10 Hrs**
Harmony in the Family and Society and Nature: Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect' – as the RightEvaluation: Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society;Vision for the Universal Human Order; Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature..	
UNIT – IV	**10 Hrs**
Implications of the Holistic Understanding – a Look at Professional Ethics Definitiveness of (Ethical) Human Conduct; A Basis for Humanistic Education, HumanisticConstitution and Universal Human Order;Competence in Professional Ethics;HolisticTechnologies, Production Systems and Management Models; Strategies for Transition towards Value-based Life and Profession	

Reference Books.

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria,2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers'ManualforAFoundationCourseinHumanValuesandProfessionalEthics,RRGaur, RAsthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034- 53-2
3. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak,1999.
4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi,2004.
5. The Story of Stuff(Book).
6. The Story of My Experiments with Truth - by Mohandas KaramchandGandhi
7. Small is Beautiful - E. F Schumacher.
8. Slow is Beautiful - CecileAndrews
9. Economy of Permanence - J CKumarappa
10. Bharat Mein Angreji Raj – Pandit Sunderlal
11. Rediscovering India - byDharampal
12. Hind Swaraj or Indian Home Rule - by Mohandas K.Gandhi
13. India Wins Freedom - Maulana Abdul KalamAzad

14. Vivekananda - Romain Rolland(English)
15. Gandhi - Romain Rolland(English)

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1	-	-	3	3	2	3	-	-	1
2	3	2	2	-	-	3	3	1	1	-	-	1
3	3	2	2	-	-	2	3	2	1	-	-	1
4	3	2	2	-	-	3	2	3	2	-	-	1
5	3	2	1	-	-	-	2	1	1	-	-	1
6	-	-	-	-	-	-	-	3	-	-	-	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102Department of Mechanical Engineering

Scheme Autonomous Syllabus (175 credits)

B.E. V SEMESTER

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1.	UME 509 C	Design of Machine Element	3	2	2	-	50	50	100
2.	UME 512C	Metal Forming	3	2	2	-	50	50	100
3.	UME 514 C	Turbo Machines	3	2	2	-	50	50	100
4.	UME 516 H	Management and Entrepreneurship	3	3	-	-	50	50	100
5.	UHS 002 N	Advanced Quantitative Aptitude and Soft Skills	1	2	-	-	50	50	100
6.	UME 513 C	Fluid Mechanics	3	3	-		50	50	100
7.	UME 5XXE	Dept Elective – I	3	2	-	-	50	50	100
8.	UME 515 L	Fuels & I.C Engine Lab	1	-	-	2	50	50	100
9.	UME 517 L	Fluid Mechanics & Machinery Lab	1	-	-	2	50	50	100
10.	UCS 559 L	Advance C programming Lab	2	-	-	4	50	50	100
		Total Credits	**23**	**16**	**06**	**08**	**500**	**500**	**1000**

Department Electives List

The Students have to select any one elective from the following table

Subject Code	Subject	Credits
UME 521 E	Quality and Reliability Engineering	3
UME 535 E	Non Traditional Machining	3
UME 546 E	Theory of Automotive Engines	3
UME 536 E	Total Quality Management	3

*** Open elective - I 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 4th and 6th semester to earn 02 credits which will be awarded during 7th Semester.

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 509 C	DESIGN OF MACHINE ELEMENTS	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 42		SEE Marks : 50

UNIT – I	12 Hrs

Introduction: Definitions: Normal, Shear, Biaxial and Triaxial Stresses, Stress Tensor, Principal Stresses Engineering Materials and their Mechanical properties, Stress-Strain diagrams, Stress Analysis, Design considerations: Codes and Standards.

Design for Static strength: Static loads and Factor of Safety, Theories of failure. Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion Energy Theory Failure of Brittle Materials, Failure of Ductile Materials, Stress Concentration, Determination of Stress Concentration Factor

UNIT – II	08 Hrs

Design for Fatigue strength : Design For Fatigue Strength: Introduction- S-N Diagram, Low Cycle Fatigue, High Cycle Fatigue, Endurance Limit, Endurance Limit Factors: Size effect, Surface effect, Stress Concentration effects. Fluctuating Stresses, Goodman and Soderberg relationship, Stresses due to Combined Loading, Cumulative Fatigue Damage.

Design of Threaded Fasteners: Stresses in Threaded Fasteners, Effect of Initial Tension, Design of Threaded Fasteners under Static, Dynamic and Impact loads, Design of Eccentrically loaded Bolted Joints.

UNIT – III	10 Hrs

Design of Shafts: Torsion of Shafts, Design for strength and Rigidity with Steady loading, ASME & BIS codes for Power Transmission shafting, Shafts under Fluctuating loads and Combined loads.

UNIT – IV	12 Hrs

Design of Springs: Definitions, Types of springs, Stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Energy stored in springs, Torsion, Belleville and Rubber springs.

Leaf Springs: Stresses in leaf springs. Equalized stresses,

Design of Spur Gears: Spur Gears: Definitions, Stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load..

DESIGN DATA HAND BOOKS:

1. Design Data Hand Book – K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
2. Design Data Hand Book – K. Mahadevan and Balaveera Reddy, CBS Publication
3. Machine Design Data Hand Book – H.G. Patil, Shri Shashi Prakashan, Belgaum.
4. PSG Design Data Handbook PSG College of Technology, Coimbatore.

Reference Books:

1. Machine Design: Robert L. Norton, Pearson Education Asia, 2001.
2. Design of Machine Elements: M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. Machine Design: Hall, Holowenko, Laughlin (Schaum‟s Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. Fundamentals of Machine Component Design: Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.
5. Mechanical Engineering Design: Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.
6. Design of Machine Elements: V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.
7. Design of Machine Element by S. C. Sharma

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

1. ***Enlighten*** the terminologies and preliminary concepts related to Normal, shear, biaxial, tri axial and Principal stresses, stress-strain diagram, codes and standards.
2. ***Apply*** the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components.
3. ***Apply*** different theories to the design of shafts subject to combined static and dynamic loads
4. ***Analyze*** and design of springs and spur gears for various loadings and applications

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
1	3	3	3	2	2	2	2	--	3	1	1	3
2	3	2	2	2	2	2	1	--	2	2	2	2
3	2	3	2	1	2	1	1	--	3	2	1	2
4	3	2	2	2	2	2	1	--	2	1	2	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 512 C	METAL FORMING	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

INTRODUCTION AND CONCEPTS: Classification of metal working processes, characteristics of wrought products, advantages and limitations of metal working processes. Concepts of true stress, true strain,. Determination of flow stress. Tresca and Von-Mises yield criteria, Numerical problems

EFFECTS OF PARAMETERS: Temperature, strain rate, friction and lubrication, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

UNIT – II	10 Hrs

FORGING : Classification of forging processes, Forging machines and equipment. Expressions for forging pressures and load in open die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Forging defects, Residual stresses in forging.

ROLLING: Classification of Rolling processes. Types of rolling mills. Roll separating force. Effects of front and back tensions, friction, friction hill. Maximum possible reduction, defects in rolled products, rolling variables. Numerical problems.

UNIT - III	10 Hrs

DRAWING: Drawing equipment and dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle and dead zone formation, drawing variables, Tube drawing and classification, Numerical Problems on wire drawing.

EXTRUSION: Types of extrusion processes, extrusion equipment and dies, lubrication and defects in extrusion. Extrusion dies, Extrusion of seamless tubes. Extrusion variables, Numerical problems.

UNIT IV	10 Hrs

SHEET METAL FORMING: Forming methods, dies and punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, defects of drawn products, stretch forming. Roll bending and contouring.

HIGH ENERGY RATE FORMING METHODS: Principles, advantages, limitations and applications of explosive forming, electro hydraulic forming and electromagnetic forming.

POWDER METALLURGY: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction, sintering, secondary finishing and secondary manufacturing operations, application of powder metallurgy components, advantages and limitations

Reference Books:

1. Surender Kumar, “Technology of Metal Forming Processes”, Eastern Economy Edition, Prentice-Hall of India Private Limited, 2008.
2. G.W.Rowe, “Principle of Industrial Metal Working Processes”, CBS Publishers and Distributors, 2005.
3. Dr. Sadhu Singh, “Theory of Plasticity and Metal forming Processes”, Third Edition, Khanna Publishers, 2013.
4. P.C. Angelo, R. Subramanian, “Powder Metallurgy: Science, Technology and Applications”, Eastern Economy Edition, Prentice-Hall of India Private Limited, 2008.

5. George E. Dieter, “Mechanical metallurgy” (SI Metric Edition), Mc Graw-Hill Series in Materials Science and Engineering, 2001.
6. B. L. Juneja, “Fundamentals of Metal Forming Processes”, Second Edition, New Age International Publishers, 2010.
7. Manufacturing Process III, Praveen Kestor

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

1. Classify, compare, choose various metal forming operations; apply, elaborate and analyze yield criteria for ductile metals and summarize the effect of parameters on these operations considering the effect of force.
2. Explain, analyze, identify and relate various forging and rolling operations with metal flow and determination with modification of the power necessary to operate the equipments.
3. Distinguish, classify and explain types of drawing and extrusion operations in terms of die angle, parts produced, variables; formulate the load required (for existing and maximize reduction) to cause plastic deformation of the metal to occur without non uniform plastic deformation with justification.
4. Explain with illustrations and outline the shape finishing operations using sheet metal working, high energy rate forming and powder metallurgy by predicting the behavioral change of the metals during plastic deformation and propose the method to shape the metal by evaluating conventional forming and/or HERF and/or P/M route.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	2	1	--	2	--	--	--	--	--	--	--	3
2	2	3	1	1	--	2	1	3	3	3	2	--
3	2	3	1	1	--	2	1	2	3	3	2	--
4	1	--	--	--	2	1	2	3	3	1	2	3

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 514 C	Turbomachines	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

Introduction: Definition of turbomachine, Parts of a turbo machine, Comparison with positive displacement machine, Classification of turbomachines, Application of dimensional analysis to turbomachines and their physical significance, specific speed for power absorbing and power developing machines, Numerical problems on dimensional analysis and model studies.

Energy Transfer in Turbo machines: Euler turbine equation, Alternate form of Euler turbine equation, Components of energy transfer, Degree of reaction, General analysis of a turbo machine, Effect of blade discharge angle on energy transfer and degree of reaction, General analysis of turbines (axial flow machines), Utilization factor, Relation between utilization factor and degree of reaction, Condition for maximum efficiency, Condition for maximum utilization factor, Optimum blade speed ratio and maximum energy transfer, Numerical problems on above topics

UNIT – II	10 Hrs

General analysis of power absorbing turbomachines: General analysis of centrifugal pumps and compressors, Effect of blade discharge angle, Analysis on performance, Theoretical head capacity relationship, Centrifugal machines stage parameters, Work done, Power, Stage pressure rise, Degree of reaction, Numerical problems on above topics.

Centrifugal Pumps: Working principle, Main parts of a centrifugal pump, Classification, Head, Static head, Manometric head, Pump Efficiencies, Manometric, Mechanical, Hydraulic, Volumetric and Overall efficiency; Work done by the pump, Pressure rise in a pump, Minimum starting speed, Multistage pumps; Cavitation, Numerical problems on above topics.

UNIT - III	10 Hrs

Steam and Gas Turbines: Impulse staging and need for compounding, Compounding, Velocity, Pressure, Velocity and pressure compounding, Impulse turbine, Performance parameters, Effects of friction and blade angles on blade efficiency, Condition for maximum efficiency, Maximum efficiency and work done, Numerical problems on above topics.

Multistage impulse turbine (two stage): work done, Blade efficiency, Condition for maximum efficiency, Maximum blade efficiency, Maximum work done, Maximum utilization factor with equiangular---------- blades, Numerical problems on above topics.

Reaction turbines: Degree of reaction, Condition for maximum efficiency (without carry over efficiency), Maximum efficiency, Maximum work done, Utilization for factor, Condition for maximum utilization factor, Maximum utilization factor, Blade design parameters, Numerical problems on above topics.

UNIT IV	10 Hrs

Hydraulic Turbine: Unit quantities, Terminology, Pelton Wheel, Velocity triangle, Power developed, Hydraulic efficiency, Condition for maximum hydraulic efficiency, Maximum hydraulic efficiency, Turbine efficiency, Hydraulic, Mechanical, Volumetric and Overall efficiency, important design parameters. Numerical problems on above topics.

Francis and Kaplan turbines: Velocity triangle, Runner shapes for different blade speeds (blade angles), Design parameters, Draft tube and types draft tubes, functions of a draft tube, Efficiency of a draft tube, Kaplan and Propeller turbines, Velocity triangles, Design parameters, Numerical problems on above topics.

Reference Books:

1. Turbines, Compressors and Fans, S.M.Yahya, Tata McGraw Hill Company 2nd Edition, 2002
2. Gas Turbine Theory, H.Cohen, GFC Rogers and HIH Saravanamuttoo, Thomson Press (India) Ltd. 4th Edition,1998.
3. Gas Turbines V.Ganeshan, Tata Mc Graw Hill 2nd edition, 2002.
4. A Treatise on Turbo machines, G.Gopalaksrihsna and D. Prithiviraj Scitech Publications (India) PVT., Limited 2002.
5. Principles of Turbo machinery, D.G.Shephered , The Macmillan Company ,1964.
6. An Introduction to energy Conversion - Volume III – Turbo machinery by A. Kadambi and Manohar Prasad New Age International publishers 1977.
7. Turbomachines book by M S Govinde Gowda and A M. Nagaraj MM Publishers, Davangeri

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

1. *Apply* the knowledge of turbo machinery terminology to *develop* governing equation for rotating machinery and classify the rotating machines.
2. *Apply* the knowledge of turbo machinery to *analyze* the power absorbing turbomachine (Centrifugal machines)
3. *Apply* the knowledge of turbo machinery to analyze the impulse and reaction steam turbines.
4. *Apply* the knowledge of turbo machinery to analyze the water turbines (Pelton, Francis and Kaplan water turbines)

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	2	1	1	1	2	1	3	3	1	1	2
2	3	2	1	1	1	2	1	3	3	1	1	2
3	3	2	1	1	1	2	1	3	3	1	1	2
4	3	2	1	1	1	2	1	3	3	1	1	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 516 H	**MANAGEMENT & ENTREPRENEURSHIP**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Management: Introduction, Meaning, nature and characteristics of Management, Scope and Functional areas of management, Management as a science, art of profession, Roles of Manager, Levels of Management, Development of Management Thought: early management approaches. **Planning :** Nature, importance and purpose of planning process, Objectives, Types of plans (Meaning only), Importance of planning – steps in planning & planning premises	
UNIT – II	**10 Hrs**
ORGANIZING AND STAFFING: Nature and purpose of organization, Principles of organization, Types of organization, Departmentation, Committees, Nature and importance of staffing, Process of Selection & Recruitment (in brief). **MOTIVATION AND BEHAVIOR**: Hawthorns studies and its findings, Maslow's theory, X and Y theory, Immaturity theory motivation hygiene theory, McClelland‟s theory of motivation.	
UNIT - III	**10 Hrs**
DIRECTING & CONTROLLING: Meaning and nature of directing, Leadership styles, Communication: Meaning and importance, Coordination: meaning and importance and Techniques of Co–Ordination. Controlling: Meaning and steps in controlling, Essentials of a sound control system, Methods of establishing control (in brief). **ENTREPRENEUR**: Meaning of Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur (only types), Role of entrepreneurs in Economic Development, Entrepreneurship in India, Entrepreneurship: its Barriers.	
UNIT IV	**10 Hrs**
SMALL SCALE INDUSTRIES: Definition, Characteristics, Need and rationale, Objectives, Scope, role of SSI in Economic Development. Advantages of SSI Steps to start and SSI, Government policy towards SSI, Different Policies of SSI, Government Support for SSI during 5 year plans. Supporting Agencies of Government for SSI, Meaning, Nature of support, Objectives, Functions (brief). **QUALITY PHILOSOPHY**: The Meaning of Quality and Quality Improvement, Brief History of Quality Methodology, Statistical Methods for Quality Control and Improvement	

Reference Books:

1. Principles of Management, P.C.Tripathi, P.N.Reddy – Tata McGraw Hill,
2. Management and Entrepreneurship, Kanishka Bedi Oxford University Press, 4th edition 2009
3. Principles of Management, Harold Koontz, Cyril O'Donnell McGraw Hill Create 5th edition 2018
4. Principles of Management, Koontz O Donnel, Mc.Graw Hill Intl. Book Co.
5. Statistical Quality Control, E.L. Grant and R.S. Leavenworth, 7thEdition, McGraw- Hill publisher
6. Entrepreneurship Development – Poornima.M.Charantimath –Small Business Enterprises – Pearson Education – 2006 (2 & 4).

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

1. Demonstrate the ability of understanding, the nature, purpose, evolution, patterns of management. Analyze the purpose of planning, distinguish different plans and able to describe the detailed process of planning.
2. Identify and apply the nature and purpose of organizing, Departmentation, Staffing, Human factors and motivation.
3. Express the need of Leadership, concepts of directing and controllingDemonstrate the importance of Entrepreneurship, role of Entrepreneur, Characteristics, and Classification of Entrepreneurs.
4. Develop the knowledge of small-scale industries, characteristics, role, and government support and quality philosophy.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	1	1	---	---	---	---	---	---	2	1	2	1
2	---	1	---	---	---	---	---	---	---	---	---	1
3	---	1	---	---	---	---	---	---	3	1	---	1
4	---	---	---	---	---	---	---	---	---	1	1	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UHS 002 N	**ADVANCED QUANTITATIVE APTITUDE AND SOFT SKILLS**	**03 - Credits (2 : 2 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**07 Hrs**
Mathematical Ability: Ratios, Averages, Percentages, Profit Loss, Interest, Time & Work.	
UNIT – II	**07 Hrs**
Analytical Ability: Analytical Puzzles, Data Analysis, Para-jumbles and miscellaneous questions.	
UNIT - III	**06 Hrs**
Group Discussions & Written Communication: Zero GD, Parameters of Evaluation, Introduction and Conclusion, Mock GDs, Introduction to Business Communication.	
UNIT IV	**05 Hrs**
Written English: Synonyms and Antonyms, Error Detection & Correction, Letter/Email Writing.	
Reference Books: 1. R. S. Aggarwal, "A Modern Approach to Verbal and Non – Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018 2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018 3. Chopra, "Verbal and Non – Verbal Reasoning", MacMillan India 4. M. Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018 **5.** Edward De Bono, "Lateral Thinking", Penguin Books, New Delhi, 2016	
Course Outcomes: At the end of the course student will be able to 1. learnt the role of verbal and non-verbal communication and enhanced his/her ability to speak in public or to an audience 2. learned the techniques to augment his/her verbal ability 3. enhanced his/her written communication and learnt techniques to augment them further 4. understood analysis of the given problem and learnt to develop a method for solving it **5.** enhanced and augmented his/her ability to work with quantitative aptitude	

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	--	--	--	--	--	--	--	--	--	3	--	2
CO2	--	--	--	--	--	--	--	--	--	3	--	2
CO3	--	--	--	--	--	--	--	--	--	3	--	1
CO4	--	3	--	--	--	--	--	--	--	--	--	2
CO5	--	3	--	--	--	--	--	--	--	--	--	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 521 E	**QUALITY AND RELIABILITY ENGINEERING**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
INTRODUCTION : Definition of quality, Quality dimensions, Quality aspects-quality of design, quality of conformance and quality of performance. Quality Control-offline quality control, statistical process control and acceptance sampling plans (Only introduction). Quality Assurance **PHICAL METHODS OF DATA PRESENTATION & QUALITY IMPROVEMENT:** Histograms, Run Charts, Pareto Diagrams, Cause and Effect diagrams and Scatter diagrams.	
UNIT – II	**10 Hrs**
STATISTICAL PROCESS CONTROL: Causes of Variation in quality, Central limit theorem, Control charts for variables and attribute (simple problem only), Process capability studies (theory only) **ACCEPTANCE SAMPLING PLANS:** Introduction, Advantages and disadvantages of sampling, producer's risk, consumer's risk, operating characteristics curve (simple problems to draw OC curve), effect of sample size and acceptance number on OC curve.	
UNIT - III	**10 Hrs**
RELIABILITY: Definition of reliability, reliability function, MTTF, hazard rate function, bathtub curve, derivation of the reliability function – constant failure rate model, time dependent failure rate models: Discrete and Continuous Distributions, Normal, Poisson, Binomial, Weibull Distribution	
UNIT IV	**10 Hrs**
SYSTEM RELIABILITY: System reliability (Series, Parallel, Mixed and Standby components). Reliability and life testing plans (failure terminated and time terminated tests). **RELIABILITY IMPROVEMENT AND ALLOCATION:** Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems	
Reference Books: 1. Statistical Quality Control- M.MahajanDhanpat Rai & Co. (P) Ltd. 2. Fundamental and Quality Control and Improvement (Second Edition)- Amitava Mitra Prentice Hall of India, 2007 3. Reliability Engineering, L. S. Srinath, East-West Press, 2008.	
Course Outcomes: At the end of the course student will be able to 1. Be able to understand the concept of quality and able to identify aspects of quality. 2. Be able to understand the process of causes for variation by conducting the process of quality control. 3. Be able to identify and analyze the failure analysis of the components and subcomponents of mechanical and electronic items. 4. Be able to know the system concepts of reliability and its improvement tradeoffs. 5.	

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 carries 20 marks and should not have more than 4 subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	**1**	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**1**			
2	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**1**			
3	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**			
4	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 535 E	NON-TRADITIONAL MACHINING	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

Introduction History, classification, comparison between conventional and non-conventional machining, need for non-traditional machining processes, process selection.

Mechanical Processes: Ultrasonic Machining: Introduction, definition, equipment,principle of material removal, process description, elements of process, tool feed mechanism, effect of process parameters, process capability, mechanics of cutting-theory of Miller, theory of Shaw, applications, advantages and limitations.

Abrasive Jet Machining: Introduction, principle, equipment, variables in AJM: carrier Gas, type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number of abrasive particles per unit volume of the carrier gas, work material, standoff distance (SOD), nozzle design, shape of cut, process characteristics - material removal rate, nozzle wear, applications, advantages and disadvantages.

UNIT – II	10 Hrs

Thermal Metal Removal Processes:

Electric Discharge Machining: Introduction, spark erosion machining processes, mechanism of metal removal, spark erosion generators, electrode feed control, power delivered by an R-C circuit, critical resistance, electrical parameters in R-C circuit, dielectric fluids, electrodes for spark erosion, electrode wear, tool electrode design, electrode material selection, flushing; pressure flushing, suction flushing, side flushing, pulsed flushing, machining accuracy, surface finish, characteristics of spark eroded surfaces, machine tool selection, applications, advantages and disadvantages.

Electron Beam Machining: Introduction, equipment for production of electron beam, generation and control of electron beam, theory of electron beam machining, thermal &non thermal types, process capabilities, applications and limitations.

UNIT - III	10 Hrs

Plasma Arc Machining: Introduction, plasma, non thermal generation of Plasma and equipment, mechanism of metal removal, PAM parameters, process characteristics, types of torches, applications, advantages and disadvantages.

Laser Beam Machining: Introduction, principle of generation of lasers, equipment and machining procedure, types of lasers, process characteristics, material removal, thermal features of laser machining, thermal analysis, cutting speed and accuracy of speed, advantages and limitations,applications.

Ion Beam Machining: Introduction, mechanism of metal removal and associated equipment, process characteristics, applications, advantages and disadvantages.

UNIT IV	10 Hrs

Electro chemical and Chemical machining processes:

Electro chemical machining: Classification of electro chemical machining processes-principle of electro chemical machining, elements of the electro chemical machining process: cathode tool, anode work piece, source of DC power, electrolyte, ECM machine, chemistry of the process, metal removal rate, tool design, tool shape correction, applications, advantages and disadvantages, electro

chemical grinding, electro chemical honing, electrochemical deburring.

Chemical Machining: Introduction, elements of process, chemical blanking process : preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, chemical milling (contour machining): process steps–masking, etching, process characteristics of CHM: material removal rate, accuracy, surface finish, applications, advantages and disadvantages.

Reference Books:

1. Hassan Abdel, Advanced Machining Processes, Mc Graw Hill, Mechanical Engineering Series.
2. HMT, Production technology, Tata Mc Graw Hill.
3. P.C Pandy& H.S. Shan, Modem Machining Process, Tata McGraw Hill.
4. ASME, Metals hand book, Vol-3.
5. F.M Wilson, High velocity forming of metals, ASTME Prentice Hall.
6. Modern Machining Processes, P.C Pandey & H.S. Shan Tata McGraw Hill 2017

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

1. Classify nontraditional machining and conventional machining processes with respect to type of energy, mechanism of material removal and process capability.
2. Compare nontraditional machining and conventional machining processes with respect to their advantages, limitations and applications.
3. Analyze various process parameters affecting the material removal rate for a particular machining process.
4. Decide a particular non-traditional machining process for a particular material, type of counter, quantity of material to be removed.

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 carries 20 marks and should not have more than 4 subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
1	1	--	--	--	1	1	--	--	--	1	1	1
2	2	2	--	1	2	--	--	--	1	1	--	1
3	3	2	1	1	1	1	--	--	2	2	--	1
4	3	3	3	1	--	--	1	--	--	1	1	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 546 E	THEORY OF AUTOMOTIVE ENGINEERING	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs
Introduction: Historical development of automobiles. Types of power plant, principle of engineoperation. Classification of engines; V- engines, stratified charge engines, variable compression ratio engine. **Fuel air cycles:**Uses of fuel air cycle, variation of specific heats, dissociation, comparison of PVdiagram of air standard cycle and fuel air cycle for SI engine, thermal efficiency and fuel consumption, effect of variables. **Two stroke and four stroke engines:**Principles of engine operation(SI and CI), scavenging -systems, theoretical processes, parameters, relative merits and demerits, valve and port timing diagrams.	
UNIT – II	**10 Hrs**
Liquid fuels: Properties and tests: specific gravity, viscosity, flash and fire points, calorific value, rating of fuels. **Petrol fuel:** Octane number, chemical energy of fuels, reaction equation, volatility properties of A/F mixture, combustion temp, combustion charts. **Combustion in SI engines:** Ignition limits, stages of combustion, ignition lag, effect of engine variables on ignition lag, effect of variables on flame propagation, abnormal combustion, detonation, theory of detonation, effect of engine variables on detonation, control of detonation, CFR engine, knock rating of SIengine fuels, surface ignition, SI engine.	
UNIT - III	**10 Hrs**
Diesel fuels: Properties and rating of fuels; cetane number, chemical energy of fuels, reaction equation, properties of A/F mixture, combustion temp, combustion charts. Vapor pressure, cloud and pour point, annealing point, diesel index, carbon residue. **Combustion in CI engines:** Stages of combustion, air fuel ratio in CI engines, delay period, variables affecting delay period, diesel knock, methods of controlling diesel knock, CI combustion chambers, open and divided. Induction swirl, turbulent combustion chambers, types, M - combustion chamber.	
UNIT IV	**10 Hrs**
Dual fuel and multi-fuel engines: Combustion in dual fuel engines, factors affecting combustion. Main types of gaseous fuels, supercharge knock control and performance of diesel fuel engines. Characteristics of multi fuel engines, modification of fuel system, suitability of various engines as multi fuel unit, performance of multi fuel engines. **Engine performance:** Performance parameters BHP, FHP, IHP, specific fuel consumption, volumetric efficiency, thermal efficiency, specific weight, heat balance sheet, testing of engines, numerical problems.	
Reference Books: 1. I.C. Engines & Air pollution by Obert, Harper & Row Roni publishers, New york, 1973 Fuels &Combustion by 2. Smith & Stinson,	

3. I.C. Engines by Lichty
4. I.C. Engines by Maleev, CBS Pub.
5. Combustion fundamentals by Roger A Strehlow
6. I.C. Engines By Mathur & Sharma, Dhanpat Rai & Sons, New Delhi, 1994
7. Fuels & Combustion by S.P. Sharma &Chandramohan, Tata McGrawHill, New Delhi ,1987

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

1. Compare and correlate between principles of engine operation, theoretical and actual cycle diagrams
2. Correlate between different types of power plants and operational fuel air cycle and valve timing diagrams of CI and SI engines
3. Analyse different phases of combustion and their significance in engine performance andstudy of combustion chambers
4. Analyse the onset abnormal combustion and its impact on the engine performance and emissions

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 carries 20 marks and should not have more than 4 subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	1	2	1	1	1	2	1	1	1	2		
2	1	1	2	2	1	1	2	2	1	1		
3	1	2	1	1	1	2	1	1	1	2		
4	1	1	1	2	1	1	1	2	1	1		

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 536 E	Total Quality Management	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

Quality and Total Quality Management:
Defining Quality and Total Quality Management (TQM), Historical Review of Quality leading to TQM, Gurus of Total Quality Management, TQM-Framework, Quality Movement in Japan, Quality Movement in India, Basic approach: Six basic concepts required by TQM.

Quality and Customer:
Cost of Quality, Determinants of Quality, Quality Statements, Customer perception of Quality, Obstacles to implement TQM, Benefits of TQM.

UNIT – II	10 Hrs

Managing Quality:
THE Deming's philosophy in terms of 14-points, Deming's Plan-Do-Check-Act (PDCA) cycle, Kaizen: The continuous improvement, Benchmarking: Introduction, The Process, Reasons to Benchmark, Six-Sigma: Meaning and Introduction.

Organizing TQM:
Quality Function Deployment (QFD), The QFD-Process, House-of-Quality, Using the House-of-Quality, Illustration to construct House-of-Quality, Benefits attributed to QFD.

UNIT - III	10 Hrs

Quality Management System:
Introduction, ISO-9000 series of standards, Benefits of ISO registration, Steps to implement Quality Management System QMS), Internal audit as key dimension of ISO-9000, Documentation procedure for ISO-9000.

Environmental Management System:
Environmental Management System (EMS): Introduction, ISO-14000 Series Standards: Organizational Evaluation Standards, Product Evaluation Standards, Concepts of ISO-14001, Benefits of EMS.

UNIT IV	10 Hrs

Failure Mode and Effect Analysis:
Introduction, Stages of Failure FMEA, The design FMEA document, Severity, Occurrence, Detection, Risk-Priority-Number (RPN), The process FMEA document, Other types of FMEA.

Seven Q.C-Tools:
Histogram, Check-Sheet, Cause and Effect Diagram, Scatter Diagram, Flow-chart, Control Charts, Pareto Charts.

Reference Books:

1. Total Quality Management, Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Besterfield-Sacre, Pearson Education Inc. and Dorling Kindersley Publishing Inc., Third Edition, Third Edition, Fifth Impression, 2007.
2. Total Quality Management Text & Cases, K. Shridhar Bhat, Himalaya Publishing House, Reprint, 2007.

3. Organizational Excellence: Introduction to Total Quality, David L Goetsch, Stanley Davis, 2015, Pearson, 8th Revised edition, ISBN-13: 9780133791853
4. Quality Management: Creating and Sustaining Organizational Effectiveness, Donna C S Summers, 2008, Pearson, 2nd edition, ISBN-13: 9780135005101
5. Fundamentals of Quality Control and Improvement, Amitava Mitra, 2016, John Wiley & Sons Inc, Fourth Edition.

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

1. Evaluate the meaning, evolution and principles of quality management and to explain how these principles can be applied within quality management systems.
2. Identify the key aspects of the quality improvement and to select and use appropriate tools and techniques for improving quality.
3. To realize the importance and applications of Quality Management System and Environmental management system.
4. Use FMEA and 7-QC tools as quality control tools.

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 carries 20 marks and should not have more than 4 subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	--	--	--	--	--	--	--	1	--	--	--	1
2	1	1	1	2	1	-	--	2	1	1	--	1
3	1	--	--	--	2	1	3	--	2	1	--	2
4	1	1	1	2	1	--	--	1	1	--	--	1

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 506 L	FLUID MECHANICS AND MACHINERY LABORATORY	01 - Credits (0 : 0 : 2)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Part A

Calibration of flow measuring device: (any 3)

a. Orifice plate
b. Flow nozzle
c. Venturimeter
d. Rotameter
e. V- Notch
f. Determination of co efficient of friction of flow through pipe
g. Determination of minor losses (Sudden Expansion, Sudden Contraction, Bend and Elbow) in flow through pipes
h. Determination of force developed by impact of jets on vanes

Part B

Group experiments

a. Performance testing of turbines
b. Pelton wheel,
c. Francis turbine
d. Kaplan turbine
e. Performance testing of pumps
f. Single stage and multi stage centrifugal pump
g. Reciprocating pump
h. Performance test on two/single stage reciprocating air compressor
i. Performance test on air blower

Scheme for Examination:

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.

1. Students will demonstrate the ability to conduct, to measure and to calculate coefficient of discharge of Venturimeter and Orificemeter.
2. Students will demonstrate the ability to calculate the effect of operating parameters on the performance of centrifugal pump and Reciprocating pump.
3. Students will demonstrate the ability to calculate the effect of operating parameters on the performance and power developed by pelton wheel, Francis turbine
4. Students will demonstrate the ability to calculate major losses and minor losses in a pipe flow

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	1	2	1	--	--	--	2	--	--	1
2	1	2	1	2	1	--	--	--	2	--	--	1
3	1	2	1	2	1	--	--	--	2	--	--	1
4	1	2	1	2	1	--	--	--	2	--	--	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 515 L	**FUEL AND I.C. ENGINE LABORATORY**	**01 - Credits (0 : 0 : 2)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Part A
Individual Experiments

1. Determination of Flash point and Fire point of lubricating oil and liquid fuel using Abel / Clevland / Pensky Martins Apparatus.
2. Determination of Viscosity of a lubricating oil using Redwood viscometer
3. Determination of Viscosity of lubricating oil using Saybolts viscometer.

Part B
Group experiments

Performance tests on I. C. Engines, calculations of IP, BP, FP, thermal efficiencies, mechanical efficiency, volumetric efficiency, air fuel ratio, SFC, BSEC, heat balance sheet for

1. Four Stroke Single Cylinder Diesel Engine
2. Four Stroke Twin Cylinder Diesel Engine
3. Four Stroke Single Cylinder Petrol Engine

Scheme for Examination:

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.

1. Students will demonstrate the ability to conduct, to measure and to calculate/analyze properties of oil/fuel
2. Students will demonstrate the ability to calculate the effect of operating parameters on the performance of SI and CI engines
3. Students will demonstrate the ability to conduct, to measure and to calculate/analyze properties of oil/fuel
4. Students will demonstrate the ability to calculate the effect of operating parameters on the performance of SI and CI engines

Scheme for Examination:

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.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	3	2	1	1	1	1	2	1	3	1	1	1
2	3	2	1	1	1	1	2	1	3	1	1	1
3	3	3	2	1	2	3	2	1	3	2	1	2
4	3	3	2	1	2	3	2	1	3	2	1	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 506 L	ADVANCE C PROGRAMMING LABORATORY	02- Credits (0 : 0 : 4)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT - I	06 Hrs
Multidimensional arrays. Self-referential structures and Unions. Pointers: Introduction, Pointers for inter function communication, Pointers to pointers, Compatibility, Lvalue and Rvalue, Examples. Pointer Applications: Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples.	
UNIT - II	**06 Hrs**
Data Structures, Classifications (Primitive &Non Primitive), Data structure Operations, Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Queues: Definition, Array Representation, Queue Operations. Programming Examples.	
UNIT - III	**06 Hrs**
Linked Lists: Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Applications of Linked lists.	
UNIT - IV	**06 Hrs**
Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals;	
Textbooks 1. Data Structures: A Pseudo-code approach with C, Gilberg&Forouzan, CengageLearning2nd Edition, 2014 2. Data Structures through C, Yashwant Kanetkar, BPB Publications, 2017.	
Reference Books 1. Data Structures: A Pseudo-code approach with C, Gilberg&Forouzan, CengageLearning2nd Edition, 2014 2. Data Structures using C, Reema Thareja, Oxford press, 3rdEdition 2012 3. An Introduction to Data Structures with Applications, Jean-Paul Tremblay & Paul G., McGraw-Hill, 2ndEdition,2013	
Web links and Video Lectures: 1. https://nptel.ac.in/courses/106/106/106106130/ 2. https://www.classcentral.com/course/edx-c-programming-pointers-and-memory-management-11533 3. https://academicearth.org/computer-science/ 4. http://nptel.vtu.ac.in/econtent/courses/BS/15PCD23/index.php	

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	2	1	1	1	1	2	1	3	1	1	1
2	3	2	1	1	1	1	2	1	3	1	1	1
3	3	3	2	1	2	3	2	1	3	2	1	2
4	3	3	2	1	2	3	2	1	3	2	1	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

Department of Mechanical Engineering

Scheme Autonomous Syllabus (175 credits)

B.E. VI SEMESTER

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1.	UME 622C	Mechanical Vibrations	3	2	2	-	50	50	100
2.	UME 623C	Heat Transfer	3	2	2	-	50	50	100
3.	UME 640 C	Engineering Economics and Financial Accounting	3	3	-	-	50	50	100
4.	UME 641 C	Project Management	3	3	-	-	50	50	100
5.	UHS 003 N	Career Planning & Professional Skills	1	-	2	-	50	50	100
6.	UME 6XX N	Open Elective-II *	3	3	-	-	50	50	100
7.	UHS 004 M	Universal Human Values – II	0	3	-	-	50	50	100
8.	UME 604 H	Operation Research	3	2	2	-	50	50	100
9.	UME 606 L	HMT Lab	1	-	-	2	50	50	100
10.	UME 608 L	Dynamics Lab	1	-	-	2	50	50	100
11.	UME 609 L	Industrial Automation Lab	1	-	-	2	50	50	100
	UME 623 P	Mini Project	2	-	-	4	50	50	100
		Total Credits	**24**	**18**	**08**	**10**	**600**	**600**	**1200**

***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.

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 622 C	MECHANICAL VIBRATIONS	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

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

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

UNIT – II	10 Hrs

DAMPED FREE VIBRATIONS: Single degree freedom systems, different types of damping, concept of cr and its importance, study of response of viscous damped systems for cases of under damping, critical a damping, Logarithmic decrement.

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

UNIT - III	10 Hrs

VIBRATION MEASURING INSTRUMENTS & WHIRLING OF SHAFTS: Vibrometer meter and accelerometer shafts with and without air damping. Discussion of speeds above and below critical speeds.

SYSTEMS WITH TWO DEGREES OF FREEDOM: Introduction, principle modes and Normal modes of vibr ordinate coupling, generalized and principal co-ordinates,.
Applications: a) Vehicle suspension. b) Dynamic vibration absorber.

UNIT IV	10 Hrs

NUMERICAL METHODS FOR MULTI DEGREE FREEDOM SYSTEMS: Introduction, Influence coefficients, M reciprocal theorem, Reyleigh's method, Dunkerley's equation. Stodola method, Method of matrix itera of determination of the fundamental natural frequency, Holzer's method.

Introduction to Noise, Vibration, Harshness (NVH) and control: Subjective response of sound: Frequer dependent human response; the decibel scale; relationship between, sound pressure level (SPL), sound and sound intensity scale; auditory effects of noise; hazardous noise.

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
5. Mechanical Vibrations: G. K. Grover
6. Mechanical Vibrations: V.P. Singh, Dhanpat Rai & Company Pvt. Ltd., 3rd edition, 2006.

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

1. Understand the fundamentals, causes and the need of mechanical vibrations and mathematical models for undammed single degree of freedom systems.
2. Analyze the mechanical model of damped free and forced vibratory system and formulating mathematical models for different damping systems.
3. 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.
4. 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 for SEE:

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 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	3	3	3	1	2	2	2	1	2	2	2	3
2	3	3	3	1	3	2	2	1	3	2	2	2
3	3	3	3	1	3	1	2	-	3	3	2	2
4	3	3	3	1	3	3	3	-	3	3	3	3

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 623 C	**HEAT TRANSFER**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**

INTRODUCTION: 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: 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: 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	**10 Hrs**

ONE-DIMENSIONAL TRANSIENT CONDUCTION: 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: 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: 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	**10 Hrs**

FORCED CONVECTION: 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 problems based on empirical relations given in the data handbook.

HEAT EXCHANGERS: 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	**10 Hrs**

RADIATION HEAT TRANSFER: 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 problems based on empirical relations given in the data handbook.

CONDENSATION AND BOILING: 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 problems based on empirical relations given in the data handbook.

Reference Books:

1. Heat Transfer by Tirumaleshwar, Pearson education, 2006
2. Principles of Heat Transfer by Kreith Thomson learning 2001
3. Fundamentals of Heat and Mass transfer By Frank P. Incropera and David P. Dewitt Johm Wiley and Sons 4th ed. 1995
4. Heat transfer, P.K. Nag, Tata Mc Graw Hill 2002
5. Heat Transfer – A Basic approach by M. NecatiOzisik Tata Mc Graw Hill International ed. 1998.
6. Heat Transfer – A Practical approach by Yunus A. Cenegal Tata Mc Graw Hill 2002

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

1. *Apply* the knowledge of heat transfer to *analyze* unidirectional conduction heat transfer problems.
2. *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.
3. *Apply* the knowledge of heat transfer fundamentals to *analyze* forced convection and heat exchanger problems.
4. *Apply* the knowledge of heat transfer fundamentals to *analyze* radiation and phase change heat transfer problems.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	2	1	1	1	2	1	3	3	1	1	2
2	3	2	1	1	1	2	1	3	3	1	1	2
3	3	2	1	1	1	2	1	3	3	1	1	2
4	3	2	1	1	1	2	1	3	3	1	1	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 640 C	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs
Introduction: 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:** 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	**10 Hrs**
Equivalent Annual worth Comparisons: 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:** Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Exercises and Discussion.	
UNIT - III	**10 Hrs**
Depreciation: Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts and types of tax. **Estimating and Costing:** 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	**10 Hrs**
Introduction Financial Statements: 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:** Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm's earning power. Comparative statements analysis.	
Reference Books: 1. Engineering economics, James L. Riggs, David D. Bedworth, Sabah U. Randhawa, Tata McGraw Hill. 4th Ed, (2002) Thirteenth reprint(2010) 2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin McGraw Hill Publication (India) Private Limited.,8th Edition (2019) 3. Mechanical Estimating and Costing, T. R. Banga, S. C. Sharma, Khanna Publishers; Seventeenth edition 4. Financial Management, I M Pandey, Vikas Publishing House; Eleventh edition (2016) 5. Financial Accounting: Principles and Practices, Jawahar Lal, Seema Srivastava, S Chand Publishing; Third edition (2014) 6. Engineering economics, Panneerselvam, R. PHI Learning, Second edition (2013), 7. Engineering economy, Thuesen H.G. PHI Learning, Second edition (2002)	

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

1. 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.
2. Evaluate the economic worth of alternatives based on their, annual equivalent-worth, rate-of return.
3. Compile the knowledge about the basic components of depreciation, estimation and costing.
4. Apply the knowledge of financial accounting & financial statements.Analyze the different financial ratios and draw inference.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2	--	1	--	--	2	--	1	1	3	1
2	1	2	--	2	--	--	--	--	--	--	3	2
3	1	2	--	--	--	--	--	--	--	--	3	3
4	1	1	--	1	--	--	--	--	--	--	3	4

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 641 C	PROJECT MANAGEMENT	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

Projects in Contemporary Organization: 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: 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	10 Hrs

Project Initiation: Strategic Management and Project Selection: 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: Functional Organization, Project Organization, Matrix Organization, Mixed Organization systems, Organizing Risk Management, Steps in Project planning, Project plan elements.

UNIT - III	10 Hrs

Project Implementation: Scheduling and Control: 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: Estimating project budgets: Top-Down budgeting, Bottom-Up budgeting, Work Element costing, An Iterative budgeting process.

UNIT IV	10 Hrs

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

Project Termination: 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.

Reference Books:

1. "Project Management: A Managerial Approach", Jack R. Meredith, Samuel J. Mantel JR, Wiley India Edition. Fifth Edition.
2. "Projects: Preparation, Appraisal, Budgeting and Implementation", Prasanna Chandra, Tata McGraw Hill Publishing Company Limited, New Delhi, Third Edition.
3. "Project Management", Dennis Lock, Publisher: Taylor & Francis.9th Edition.

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

1. 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.
2. Identify and Analyze the Skills, Abilities, Authorities and Responsibilities of a project manager. Reinforce project implementation techniques through Gantt chart, PERT and CPM

3. Exhibit attitude towards Co-ordination, Communication & information system required for a project. Perform scheduling, monitoring, and controlling the work-progress of a project.
4. Demonstrate effective & integrative Strategies, types & possible evaluation of project termination and display ethical dimensions of project inventory management.

Question paper pattern for SEE:

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

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	--	--	--	--	--	--	--	--	1	1	1	--
2	1	--	--	--	--	--	--	--	--	--	1	--
3	2	2	--	--	--	--	--	--	1	--	2	--
4	1	--	--	--	--	---	---	--	--	--	1	---

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

BVVS	**UHS 003 N**	**CAREER PLANNING & PROFESSIONAL SKILLS**	**03 - Credits (3 : 0 : 0)**
	Hrs./Week : 03		CIE Marks : 50
	Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Reasoning Ability: Boolean Logic, Cryptarithms, Critical Reasoning, Verbal and Non-Verbal Reasoning	
UNIT – II	**10 Hrs**
Written & Spoken English: Reading Comprehension, Sentence Completion, Recap of sounds and stress, Pausing and Rhythm	
UNIT - III	**10 Hrs**
Mathematical Thinking: Taking Time to Work with Distances, Permutations, Probability, Data Sufficiency	
UNIT IV	**10 Hrs**
Interview Skills: Mock GDs, Résumé Writing, FAQs in HR Interviews, Interview Etiquette, Team & Leadership Skills	

Reference Books:

1. R. S. Aggarwal, "A Modern Approach to Verbal and Non – Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018.
2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018.
3. Chopra, "Verbal and Non – Verbal Reasoning", MacMillan India.
4. M Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018.
5. 5. Edward De Bono, "Lateral Thinking", Penguin Books, New Delhi, 2016.

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

1. learnt to handle personal interviews successfully
2. enhanced the usage and understanding of the various structures in the English Language
3. augmented his/her leadership and team workmanship skills
4. understood analysis of the given problem and learnt to develop a method for solving it.
5. enhanced and augmented his/her ability to work with quantitative problems.

Question paper pattern for SEE:

Evaluation Methodology:

Continuous Internal Evaluation:

3CIEs with 30 Objective Questions in 60 minutes(3 x 15 marks)

1 assignment of 5 marks (in class oral/written conduction in the form of GD/PI/test)

Semester Ending Examination: 50 Objective Questions in 90 minutes covering entire syllabus

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	--	--	--	--	--	--	--	--	--	3	--	2
CO2	--	--	--	--	--	--	--	--	--	3	--	3
CO3	--	3	--	--	--	--	--	--	--	--	--	--
CO4	--	3	--	--	--	--	--	--	--	--	--	--

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 604 H	**OPERATION RESEARCH**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
INTRODUCTION: Definition, scope of Operations Research (OR) approach and limitations of OR Models, Characteristics, and phases of OR **LINEAR PROGRAMMING PROBLEMS** Linear programming, graphical method, simplex method, Two-phase method, duality theory, dual simplex method.	
UNIT – II	**10 Hrs**
TRANSPORTATION PROBLEMS 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** Formulation, unbalanced assignment problem, travelling salesman problem	
UNIT - III	**10 Hrs**
SEQUENCING 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:** 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	**10 Hrs**
GAME THEORY 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** 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.	
Reference Books: 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 **3.** Operation Research-AM Natarajan, P. Balasubramani, A Tamilaravari-Pearson-2005 **4.** Operations Research-S. D. Sharma-Kedarnath Ramanath and Co-2008	
Course Outcomes: By the end of course students, 1. 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 2. Be able to build and solve Transportation Models and Assignment Models 3. 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. **4.** Be able to implement practical cases, by using Game theory and Replacement techniques	

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	2	3	3	3	3	1	2	1	3	2	2	3
2	3	3	3	3	3	1	1	2	3	3	3	3
3	2	2	2	2	1	1	2	1	3	1	2	1
4	3	3	3	2	3	3	1	3	3	2	3	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 606 L	**HEAT & MASS TRANSFER LABORATORY**	**01 - Credits (0 : 0 : 2)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

	21 Hrs

Part A

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

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

	21 Hrs

Scheme for Examination:

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.

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

CO1: Define, Apply and Analyze unidirectional conduction heat transfer problems.

CO2: Define, Apply and Analyze transient heat transfer problems and fluid flow fundamentals to natural and forced convection heat transfer problems.

CO3: Define, Apply and Analyze forced convection and heat exchanger problems.

CO4: Define, Apply and Analyze heat radiation and phase change heat transfer problems.

Scheme for Examination:

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.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	2	1	1	1	2	1	3	3	1	1	2
2	3	2	1	1	1	2	1	3	3	1	1	2
3	3	2	1	1	1	2	1	3	3	1	1	2
4	3	2	1	1	1	2	1	3	3	1	1	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 608 L	**DYNAMICS LABORATORY**	**01 - Credits (0 : 0 : 2)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

21 Hrs

PART – A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in

a. single degree of freedom vibrating systems (longitudinal and torsional)

2. Balancing of rotating masses.
3. Determination of critical speed of a rotating shaft.
4. Determination of Fringe constant of Photo elastic material using.
5. Circular disc subjected to diametric compression.
6. Pure bending specimen (four point bending)
7. Determination of Fringe constant using Photo elasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression.

PART – B

1. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Prowel /Hartnel Governor. (Only one or more)
2. Determination of Pressure distribution in Journal bearing.
3. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
4. Determination of natural frequency of compound pendulum.
5. Experiments on Gyroscope

Scheme for Examination:

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.

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

1. Verify and analyse of the concept of the gyroscopic couple with torque from motorized Gyroscope.
2. Determine logarithmic decrement, damping factor from damped free vibration test with Variable damping for Longitudinal and torsional system.
3. Compare the experimental speed with theoretical speed from whirling speed of shaft with observation of modal shapes.
4. Constructing Mohr's circle and obtaining of principal stresses from strain rosette gauge experiment.

Scheme for Examination:

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.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	2	1	--	2	--	--	--	--	--	--	--	3
2	2	3	1	1	--	2	1	3	3	3	2	--
3	2	3	1	1	--	2	1	2	3	3	2	--
4	1	--	--	--	2	1	2	3	3	1	2	3

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME XXX L	**Industrial Automation Laboratory**	**01 - Credits (0 : 0 : 2)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

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

Scheme for Examination:

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.

1. Each individual should develop competence in technologies of automation.
2. Capable to develop simple control systems and study the system response.
3. Individual should be able to understand the communication system in automation.

Scheme for Examination:

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.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1												
2												
3												
4												

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 623 P	**Mini Project**	**01 - Credits (0 : 0 : 2)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Course Objective and outcomes:

To explore the problems in the society ,Industry, Agriculture etc and plan and design the solution

Project outcome

Literature Survey

Project problem definition

Submission of project proposal

Scheme of examination
CIE – 50 Marks
Project Report + Submission

SEE – 50 Marks
Presentation Viva-voce

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	**Programme Outcomes (POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2			2	2	3	2	3	1	1	1
2	1	1	2	2	1	3	3	1	1	1	1	1
3	1	1	1	1	1	3	3	2	1	1	2	1
4	1	2	2	1	2	2	2	3	2	1	2	1
5	2	2	2	1	2	3	2	1	1	1	2	1
6	1	1	1	1	2	1	1	3	1	1	1	1

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

BVVS

UHS 004 M	**Universal Human Values – II**	**03 - Credits (3: 0: 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 100

UNIT – I	**10 Hrs**
Introduction to Value Education: Right Understanding;Relationship and Physical Facility;UnderstandingValue Education;Self-exploration as the Process for Value Education,Continuous Happiness and Prosperity -the Basic Human aspiration-Current Scenario and Method to Fulfill the Basic Human Aspirations.	
UNIT – II	**10 Hrs**
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self,Understanding Harmony in the Self, Harmony of the Self with the Body,Programme to ensure self-regulation and Health.	
UNIT – III	**10 Hrs**
Harmony in the Family and Society and Nature: Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect' – as the RightEvaluation: Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society;Vision for the Universal Human Order; Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature..	
UNIT – IV	**10 Hrs**
Implications of the Holistic Understanding – a Look at Professional Ethics Definitiveness of (Ethical) Human Conduct; A Basis for Humanistic Education, HumanisticConstitution and Universal Human Order;Competence in Professional Ethics;HolisticTechnologies, Production Systems and Management Models; Strategies for Transition towards Value-based Life and Profession	

Reference Books.

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria,2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers'ManualforAFoundationCourseinHumanValuesandProfessionalEthics,RRGaur, RAsthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034- 53-2
3. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak,1999.
4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi,2004.
5. The Story of Stuff(Book).
6. The Story of My Experiments with Truth - by Mohandas KaramchandGandhi
7. Small is Beautiful - E. F Schumacher.
8. Slow is Beautiful - CecileAndrews
9. Economy of Permanence - J CKumarappa
10. Bharat Mein Angreji Raj – Pandit Sunderlal
11. Rediscovering India - byDharampal
12. Hind Swaraj or Indian Home Rule - by Mohandas K.Gandhi
13. India Wins Freedom - Maulana Abdul KalamAzad
14. Vivekananda - Romain Rolland(English)
15. Gandhi - Romain Rolland(English)

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1							3	2	3	-	-	1
2						3	3	1	1	-	-	1
3						3	3	2	1	-	-	1
4						2	2	3	2	-	-	1
5						3	2	1	1			1
6								3				1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 639 N	Product Design and Rapid Prototyping	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs
Introduction : Definition , importance of PD, Objectives of PD,essential requirements of PD, who designs product, Project team, steps in new PD, Characteristics of successful product development, duration and cost of product development , challenges of product development, Design for manufacture, re-manufacturing , sequential and concurrent engineering . **Design for manufacture & assembly:** Design for Manufacture and Assembly, History , Implementation of Design for Assembly , Design for Manufacture , How Does DFMA Work, Advantages of Applying DFMA during Product Design design for Maintainability, Design for Environment Design for safety, Vision and Illumination design	
UNIT – II	**10 Hrs**
Development processes and organizations: A generic development process, Usefulness of a well-defined Development Process, task & responsibilities for marketing, design and manufacturing , concept development: the front end process, adopting the generic product development process, process flow diagram for variant of products, product development organizations (functional, project & matrix)	
UNIT - III	**10 Hrs**
Introduction to RP **Prototype fundamentals**,definition of Prototypes, types of prototypes, need for the compression in product development, RP fundamentals , RP wheel, history of RP systems, applications of RP, growth of RP industry, basic principle of rapid prototyping processes, classification of RP systems . advantages and disadvantages of rapid prototyping. **Stereolithogrphy systems:** principle, process details , advantages and disadvantages, applications	
UNIT IV	**10 Hrs**
Selective Laser sintering: principle, process details , advantages and disadvantages, applications **Fused deposition modeling**: principle, , process details , advantages and disadvantages, applications **Laminated object manufacturing :** principle, process details, LOM materials advantages and disadvantages, applications **Solid Ground curing:** principle of operation , machine details, advantages and disadvantages, applications	
Reference Books: 1. The design of everyday things by Don Norman 2. Product designs from concept to Manufacture by Jennifer Hudson 3. Additive manufacturing by Brent Stucker, David W. Rosen, and Ian Gibson 4. Engineering design and rapid prototyping by Ali K. Kamrani and Emad Abouel Nasr 5. Product design & development by Karl T Ulrich and Steven D Eppinger 6. Rapid Prototyping principles and applications by C K Chua, K F Leong and C S Lim	

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

5. Express basics of product design as a means to manage the development of an idea from concept to production
6. Analyze evaluate and apply the generic method for product development
7. Evaluate basics of prototyping
8. Demonstrate Stereolithogrphy , selective laser sintering , fused deposition modeling , laminated object manufacturing & solid ground curing

Question paper pattern for SEE:

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

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	1	1	1	1	1	1	1	1	1	1	2	1
2	2	1	1	2	1	2	2	1	3	2	2	1
3	1	3	1	1	1	1	2	1	1	1	1	1
4	3	3	1	2	1	2	1	1	3	2	2	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102Department of Mechanical Engineering

Scheme Autonomous Syllabus (175 credits)

B.E. VII SEMESTER

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1.	UME 704 C	Finite Element Methods	3	2	2	-	50	50	100
2.	UME 7XX E	Dept Elective – II	3	3	-	-	50	50	100
3.	UME 7XX E	Dept Elective – III	3	3	-	-	50	50	100
4.	UME 7XX E	Dept Elective – IV	3	3	-	-	50	50	100
5.	UME 7XX N	Open Elective – III	3	3	-	-	50	50	100
6.	UME XXX X	**Online Course**	3	-	-	-	-	-	100
7.	UME 705 L	CAE Lab	1	-	-	2	50	50	100
8.	UME 706 L	CNC Lab	1	-	-	2	50	50	100
9.	UME 721 P	Project Phase –I	3	-	-	6	50	50	100
10.	UME 722 I	Internship	2	-	-	4	50	50	100
		Total Credits	**25**	**16**	**02**	**14**	**500**	**500**	**100**

Open elective - III 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.

Electives offered by the Department:

The Students have register for any three-elective selecting maximum one from each group

Group – I	Group – II	Group – III	Group - IV
UME 732 E: Non-Destructive Testing **UME 716 E: Advanced Manufacturing Technology** **UME 712 E: Composite Materials**	UME 727 E: Control Engineering UME 728 E: Tool Design	UME 720 E: Power Plant Engineering UME 729 E: Refrigeration & Air conditioning	UME 730 E: Operation Management

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 704 C	FINITE ELEMENT METHODS	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	12 Hrs

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, stress strain relations for plane stress and plane strain, Boundary conditions, Initial conditions, Euler's Lagrange's equations of bar, beams, Principle of a minimum potential energy, principle of virtual work, Rayleigh-Ritz method Galerkins method and Matrix techniques .

Basic Procedure: General description of Finite Element Method, , Discretization process; types of elements 1D, 2D and 3D elements, size of the elements, location of nodes, node numbering scheme, half Bandwidth, Stiffness matrix of bar element by direct method, Properties of stiffness matrix, Preprocessing, post processing. Engineering applications of finite element method. Advantages & Disadvantages of FEM.

UNIT – II	08 Hrs

Interpolation Models: Polynomial form of interpolation functions- linear, quadratic and cubic, Simplex, Complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, , static condensation. penalty approach and elimination method.

one dimensional bar element: Recall of 1D linear bar element. Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Effect of temperature on 1D elements and stress calculation.

UNIT – III	10 Hrs

TWO dimensional elements: Shape functions and stiffness matrix of 2D elements four-Node quadrilateral, Nine-Node quadrilateral Eight-Node quadrilateral, serendipity and lagrange comparison with 2D pascals triangle. CST and LST shape functions ,jacobian matrix , stiffness matix, force terms, stress calculation and Numerical integration. Introduction to 3-D elements shape function of tetrahedron element

UNIT – IV	12 Hrs

TRUSSES AND BEAM ELEMENTS: Analysis of trusses and beam elements its shape functions, stiffnesmatrix and stress calculation

Heat Transfer Problems: Steady state heat transfer, 1D heat conduction governing equation, boundary conditions, One dimensional element, Functional approach for heat conduction, Galerkin approach for heat conduction, heat flux boundary condition, 1D heat transfer in thin fins

DESIGN DATA HAND BOOKS:

1. Design Data Hand Book – K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
2. Design Data Hand Book – K. Mahadevan and Balaveera Reddy, CBS Publication
3. Machine Design Data Hand Book – H.G. Patil, Shri Shashi Prakashan, Belgaum.
4. PSG Design Data Handbook PSG College of Technology, Coimbatore.

Reference Books:

1. The FEM its basics and fundamentals: O.C.Zienkiewicz, Elsevier, 6e.
2. Finite Element Method,J.N.Reddy, McGraw –Hill International Edition.
3. Finite Element Methods, by Daryl. L. Logon, Thomson Learning 3rd edition, 2001.
4. Finite Element Analysis, by H.V. Lalshminarayana,universities press, 2004.
5. Finite Elements in engineering,Chandrupatla T.R., 3rd Pearson Edition.
6. Finite Element Analysis,C.S.Krishnamurthy,–Tata McGraw Hill Publishing Co. Ltd, New Delhi, 1995.
7. "Fundamental Finite Element Analysis and Application" by "Asghar Bhatti" by PageTurner 2013.
1. "Advanced Topics in Finite Element Analysis of Structures with Mathematica and MATLAB Computations" by M. Asghar Bhatti by PageTurner 2013.

Course Outcomes:

1. Understand the fundamental theory of the FEM method, Generate the governing FE equations for systems governed by partial differential equations
2. Understand the role and significance of shape functions in finite element formulations and use linear, quadratic, and cubic shape functions for interpolation. Apply the FEM method to solve Bars subject static load and thermal load.
3. Understand the formulation of two-dimensional elements (triangle and quadrilateral elements). Apply the concept of Lagrange interpolation for 3D elements.
4. Understand the formulation of truss, beams and Heat transfer concept. Apply the FEM method to solve truss and beams.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of Pos with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	2	2	2	1	1	2	1	1	1	3
2	3	2	3	2	2	2	1	1	1	1	1	2
3	2	3	2	2	2	1	2	2	1	1	1	1
4	2	2	3	2	2	1	2	1	1	1	1	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 732 E	NON DESTRUCTIVE TESTING	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs
Introduction to ND Testing: Information gathered from NDT, Defects in manufacturing Advantages and disadvantages of NDT, Comparison of destructive & Non-destructive tests, Methods of NDT, Common application of NDT, Flaw detection & evaluation, leak detection & evaluation, Non Destructive Evaluation, visual inspection Replication microscopy technique for Non Destructive Evaluation: Specimen preparation, replication techniques, and micro structural analysis	
UNIT – II	**10 Hrs**
Liquid Penetrant Inspection: Principles, penetrant methods, procedure, materials used,equipment, parameters and applications Magnetic Particle Inspection: Principle, general procedure, advantages & limitations , applications , magnetic field generation, types of magnetic particles and suspension liquids, Direction of the Magnetic Field ,Importance of Magnetic Field Direction	
UNIT - III	**10 Hrs**
Radiography Inspection: principle, X-ray radiography, equipment, Gamma-ray radiography, real time radiography & film radiography , radiation safety ,advantages, disadvantages and applications of radiography Computed tomography: Principles, capabilities, comparison to other NDE methods, CT equipments, industrial computed tomography applications	
UNIT IV	**10 Hrs**
Ultrasonic inspection: Basic equipment, advantages & limitations, inspection methods pulse echo A, B, C scans transmission transducers & couplants Thermal Inspection: Principles, equipment, inspection methods applications Eddy Current Inspection: Principles of operation, procedure, advantages & limitations, operating variables, inspection coils, eddy current instruments, application examples	
Reference Books: 1. NON DESTRUCTIVE EVALUTION AND QUALITY CONTROL, METALS HAND BOOK, AMERICAN SOCIETY OF METALS, 9TH , EDITION 2001 2. NON DESTRUCTIVE –GARDEN AND REACH, MC GONNAGLE JJ NEWYORK	
Course Outcomes: By the end of course with aid of design data handbook students shall be able to, 1. To have a basic knowledge of surface N D E techniques which enable to carry out various inspection in accordance with the established procedures. 2. Differentiate various defect types and select the appropriate N D T methods for better evaluation 3. Documentation of the testing and evaluation of the results for further analysis **4.** Students will be able to understand significance and suitability of various non destructive testing methods in industrial application.	

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
1	3	1	--	3	2	--	3	1	3	1	--	3
2	2	1	--	1	1	--	2	--	3	--	--	3
3	3	--	--	2	--	1	1	2	2	--	--	2
4	1	2	1	2	--	--	--	1	--	2	1	1

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 716 C	ADVANCED MANUFACTURING TECHN0LOGY	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs
Introduction: Introduction to CAD/CAM, product system facilities: Low, medium and high. Manufacturing support systems, Automation in production systems. Automated manufacturing systems. Computerized manufacturing systems. Reasons for automating, Automation principles and strategies. Discussions. **Fundamentals of Automated Production Lines:** Introduction, System configurations, Workpart transfer mechanisms, Storage buffers, Control of the production line.	
UNIT – II	**10 Hrs**
Analysis of Transfer Lines: Analysis of Transfer Lines with no internal storage: Basic terminology and Performance measures, Workstation breakdown analysis: Upper bound approach, Lower bound approach, and Analysis of Transfer Lines with storage buffers. Numerical examples. **Automated Assembly System:** Introduction, System configurations, Parts delivery at workstations, Applications. Quantitative analysis: Parts delivery system, Multi-station and single station assembly machines. Partial automation.	
UNIT - III	**10 Hrs**
NC Part Programming: Basic components of an NC system, EIA and ISO coding standards, NC part programming exercises. **Computer Assisted Part Programming:** Defining part geometry**,** Specifying tool path and operation sequence, Computer task in computer-assisted part programming, Part programming with APT exercises.	
UNIT IV	**10 Hrs**
Product life cycle management: Introduction, Product information, PLM framework, Benefits, Implementation, Enabling technologies, Example of business problem. Product data management: Evolution of PDM systems, Scope, Benefits, Implementation, Software capabilities, software functions **Advances in Automated Factory:** Industry 4.0**:** functions, applications and benefits, Components of Industry 4.0, Internet of things (IoT), IoT applications in manufacturing, Big-Data and cloud computing for IoT, IoT for smart manufacturing	
Reference Books: 1. Industry 4.0 Google Search on the content 2. Groover M. P., Automation, Production Systems and CIM, Prentice Hall of India, 2008. 3. Ibrahim Zeid, Mastering CAD/CAM, Tata McGraw Hill, 2008. 4. P. N. Rao, CAD/CAM Principles and Applications, 2nd Edition 5. Computer Integrated Manufacturing, Bharat Vijamuri, Sunstar Publisher, 4th Edition, 2018.	

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

1. Read and demonstrate good comprehension of study of two aspects of production systems and how they are sometimes automated and /or computerized in modern industrial practice.
2. will demonstrate the ability to
    - Apply basic methods of examination of the technology of automated production lines and develop several mathematical models that can be used to analyze their operation.
    - Use of mechanized and automated devices to perform the various assembly tasks in an assembly line or cell.
3. will demonstrate the ability to
    - Evaluate, integrate, and apply programmable automation in which the mechanical actions of the machine tool or other equipment are controlled by a program containing coded alphanumeric data.
4. will be able to
    - Properly understand PLM; why it is crucial for companies to implement, what a PLM system offers, what PDM is and its relationship to PLM.
    - Study the functions and components, applications and benefits of Industry 4.0, Concept of IoT.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2	2	1	2	1	2	2	3	2	1	--
2	2	2	1	1	1	1	2	1	2	1	2	2
3	2	1	2	1	1	3	--	1	2	2	1	1
4	2	2	2	3	1	1	2	--	2	1	1	--

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 712 E	COMPOSITE MATERIALS	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

Introduction to composite materials:

Definition and classification of composites based on matrix and reinforcement, Characteristics of composite materials, Fibrous composites, Laminate composites and particulate composites. Factors which determine the properties of composites, Benefits of composites, properties and types of reinforcements and matrices, Reinforcement-matrix interface.

UNIT – II	10 Hrs

Polymer matrix composites:

Introduction, Polymer matrices, Processing methods like Lay up and curing, open and closed mold process- hand lay up techniques, laminate bag molding, production procedures for bag molding, filame winding, pultrusion, pulforming, thermo-forming, molding methods, properties of PMCs and applicatio Some commercial PMCs.

UNIT - III	10 Hrs

Metal matrix composites:

Introduction, Metallic matrices, Classification of MMCs, Need for production of MMCs, Interface reactions, processing methods like Powder metallurgy, diffusion bonding, Melt stirring, Compo/Rheo casting, Squeeze casting, Liquid melt infiltration, Spray deposition and In situ Processes, Properties of metal matrix composites, Applications, Some commercial MMCs.

UNIT IV	10 Hrs

Mechanics of composite materials :

Continuous fibers, Iso-stress condition, Iso-strain condition, critical volume fraction of fiber and minimum volume fraction of fiber, Numericals on modulus of rigidity, and mechanics of discontinuous fibers, stress Vs strain curves for PMCs, MMCs, and CMCs. Cutting and machining of composites: Reciprocating knife cutting, cutting of cured composite, Joining of composites: Mechanical fastening, Adhesive bonding.

Reference Books:

1. MeingSchwaitz, “Composite materials hand book”, McGraw Hill Book Company. 1984
2. Composite Materials-Production Properties, Testing and Applications-Narosa Publishing House
3. Robert M. Jones, “Mechanics of Composite Materials”, McGraw Hill Kogakusha Ltd. 1998.
4. Forming Metal Hand Book 9th edition, ASM Hand Book, and v15. 1998, P327-38.
5. Mechanics of composites by Artar Kaw, CEC Press, 2002
6. Composite materials By S.C. Sharma Publishing House, 2000.
7. Composite Science and Engineering By K. K. Chawala Springer Verlag 1998.
8. Introduction to composite materials by Hull and Clyne, Cambridge University Press, 2nd edition, 1990.
9. Composite Materials: Engineering and Science – F. L. Mathew and R. D. Rawlings, Woodhead Publishing Limited

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

1. Define the composites, matrix and reinforcement, the types, benefits and properties of composites.
2. Explain polymer matix composites, their production methods, applications
3. Define and explain metal matix composites, their production methods, applications
4. Understand the mechanics of composite materials, solve the numerical on modulus of rigidity, cutting and joining of composite materials

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2	2	1	2	1	2	2	3	2	1	--
2	2	2	1	1	1	1	2	1	2	1	2	2
3	2	1	2	1	1	3	--	1	2	2	1	1
4	2	2	2	3	1	1	2	--	2	1	1	--

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 727 E	CONTROL ENGINEERING	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

INTRODUCTION: Concept of automatic controls, open and closed loop systems, concepts of feedback, requirement of an ideal control system. Types of controllers – Proportional, Integral, Proportional Integral, Proportional Integral Differential controllers.

MATHEMATICAL MODELS: Transfer function models, Models of Mechanical systems, Hydraulic systems.

UNIT – II	10 Hrs

BLOCK DIAGRAMS AND SIGNAL FLOW GRAPHS: Transfer Functions definition, function, blocks representation of system elements, reduction of block diagrams, signal flow graphs: Mason's gain formula.

TRANSIENT AND STEADY STATE RESPONSE ANALYSIS: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's –Hurwitz Criterion.

UNIT - III	10 Hrs

FREQUENCY RESPONSE ANALYSIS: Polar plots: Stability Analysis, Relative stability concepts, phase and gain margin, Bode Plots: stability analysis using Bode plots, Simplified Bode Diagrams.

UNIT IV	10 Hrs

ROOT LOCUS PLOTS: Definition of root loci, general rules for constructing root loci, Analysis using root locus

CONTROL ACTION AND SYSTEM COMPENSATION: Series and feedback compensation, Physical devices for system compensation.

Reference Books:

1. Control systems Engineering U.A. Bakshi and V.U.Bakshi Technical Publications Pune 3rd edition 2011
2. Control Systems Joseph Distefano and Allen Stubberud Schaum's Outline Series 3rd edition 2017
3. Modern Control Engineering Katsuhiko Ogata University of Minnesota. Prentice Hall, New Jersey 5thedition, 2010
4. Control systems Engineering I.J. Nagrath and M. Gopal New Age International Publisher 6thedition, 2018

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

1. Study the fundamental concepts of Control systems and mathematical modeling of the system.
2. To study the concepts of block diagrams & signal flow graph and the basic concepts of proportional, integral, and derivative (PID) control.
3. To study the characteristics of closed-loop control systems, including steady-state and transient response, parametric sensitivity, disturbances, error, and stability.
4. To learn the basics of stability analysis of the system

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 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.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	2	1	2	1	2	2	--	2	2	2	2
2	2	3	2	2	1	2	2	--	2	2	2	2
3	3	2	3	3	2	1	2	--	2	1	1	2
4	3	2	2	2	2	1	2	--	1	2	2	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 728 E	TOOL DESIGN	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

Tool Design Methods: Introduction, the design procedure, drafting, and design techniques in tooling drawing.

Design of Cutting Tools: Introduction, the metal cutting process, revision of metal cutting tools-single point cutting tools, milling cutters, drills and drilling, reamers, taps, selection of carbide tools, determining the insert thickness for carbide tools.

UNIT – II	10 Hrs

Locating and Clamping Methods: Introduction, basic principle of location, locating methods and devices, basic principle of clamping.

Design of Drill Jigs: Introduction, types of drill jigs, general considerations in the design of drill jigs, drill bushings, methods of construction.

UNIT - III	10 Hrs

Design of Fixtures: Introduction, types of fixtures, fixtures and economic.

Design of Press-working Tools: Power presses, cutting operations, types of die – cutting operations and their design, evolution of blanking and progressive blanking.

UNIT IV	10 Hrs

Design of Sheet Metal Bending, Forming and Drawing Dies: Introduction, bending dies, forming dies, drawing dies, evolution of a draw die, progressive dies and selection of progressive dies. Strip development for progressive dies, evolution of progressive dies, examples of progressive dies. Extrusion dies, drop forging dies and auxiliary tools, problems.

Plastics as Tooling Materials: Introduction, plastics commonly used as tooling materials, application of epoxy plastic tools, construction methods, metal forming operations with Urethane dies, calculating forces for Urethane pressure pads, problems.

Reference Books:

1. Cyril Donaldson, G H Lecain and V C Gold. Tool Design, 3rd edition, TMH Publishing Co. Ltd. New Delhi, 2000
2. ASTME, Fundamentals of Tool Design, PHI (P) Ltd. New Delhi, 1983
3. Machine Tool Design and Numerical Control N. K. Mehta Tata McGraw Hill Publisher (P) Ltd, New Delhi 2006
4. Fundamentals of tool design Wilson F. W. ASME PHI, New Delhi 1984

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

1. ***Elucidate*** the design procedure and design of cutting tools.
2. ***Analyze*** the locating and clamping methods and design of jigs
3. ***Design*** of fixtures, press working tools, press tool operations and their economy
4. ***Design*** of sheet metal bending, forming and drawing dies and ***Analyze*** the commonly used polymer tooling materials and design aspects like pressure and forces etc.,

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 carries 20 marks and should not have more than 4 subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2	3	1	3	--	--	--	--	--	--	1
2	1	2	3	1	1	--	--	--	--	--	--	1
3	2	2	2	1	3	--	--	--	--	--	--	2
4	1	1	2	2	2	--	--	--	--	--	--	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 720 E	**POWER PLANT ENGINEERING**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Introduction: Energy and power, Sources of power, Need power generation, Power plant cycles and classification of power plant cycles, Layout of modern steam power plant, Essential requirements of steam power station, Selection of site for steam power station, Capacity of steam power plant, Choice of steam conditions. **Steam Power Plant:** Different types of fuels used for steam generation, Coal handling, Requirements of good coal handling plant, Coal handling systems, Equipment for burning coal in lump form, Strokers, Different types of stokers, Advantages and disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, Unit system and bin system, Coal burners, Fluidized bed combustion.	
UNIT – II	**10 Hrs**
Ash and dust handling: Ash handling equipment and ash handling systems, Dust collection, Removal of smoke and dust, Dust collectors, Efficiency of dust collectors, Uses of ash and dust, General layout of ash and dust collection systems, Fly ash, Fly ash composition, disposal and application. **Chimney draught:** Classification, Natural draught, Chimney height and diameter, Condition for maximum discharge through chimney, Efficiency of chimney, Draught losses, Artificial draught, Forced, Induced and Balanced draught, Advantages of mechanical draught, Numerical problems on chimney draught	
UNIT - III	**10 Hrs**
Boilers: Classification and comparison, Selection of a boiler, Essentials of good boiler, Generation of steam using forced circulation, High and supercritical pressures, L Mont, Benson, Velox, Schmidt, Loeffler and Ramson steam generators. **Accessories:** Accessories for the Steam Generator such as super-heaters, Desuperheater, Control of super heaters, Economisers, Air Pre-heaters and re-heaters, Feed water heaters and evaporators **Performance of boilers:** Evaporative capacity, Equivalent evaporation, Factor of evaporation, Boiler efficiency, Heat losses in a boiler plant, Numerical problems on boiler performance.	
UNIT IV	**10 Hrs**
Steam turbines: Steam nozzles, Nozzle efficiency, Compounding of steam turbines, Difference between impulse and reaction steam turbines, Turbine efficiencies. Steam condensers; Classification, Comparison between jet and surface condensers, Numerical problems on steam turbines. **Cooling ponds and Cooling towers:** Introduction, Natural and artificial ponds, Cooling ponds, Spray ponds. Cooling towers: Introduction, Natural and forced draft cooling towers, Comparison between natural and forced draft cooling towers. Feed water treatment: Impurities in water and troubles caused by the impurities, Methods of feed water treatment, pH value of water. **Cogeneration power plants:** Classification, Topping and bottoming cycles, Advantages and	

disadvantages of steam power plants.

Reference Books:

1. Power Plant Engineering, P.K Nag, 3rd Ed. Tata McGraw Hill2nd ed 2001,
2. Power Plant Engineering, R.K.Rajput, 4 th Ed. Laxmi Publications, 2008,
3. Power Plant Technology, M.M. EL-Wakil, McGraw Hill, International. 1994
4. Power Plant Engineering, Domakundawar, Dhanpath Rai sons.2003

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

1. *Apply* the knowledge of power plant engineering in selecting the types of fuels and burning methods to produce steam.
2. *Apply* the knowledge of power plant engineering in selecting ash, dust handling and chimney draught for a steam power plant.
3. *Apply* the knowledge of power plant engineering to *analyze* boilers, boiler accessories and performance of boilers.
4. *Apply* the knowledge of power plant engineering to *analyze* steam turbines, cooling ponds, cooling towers and co-generation power plants.

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 carries 20 marks and should not have more than 4 subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	2	1	1	1	2	1	3	3	1	1	2
2	3	2	1	1	1	2	1	3	3	1	1	2
3	3	2	1	1	1	2	1	3	3	1	1	2
4	3	2	1	1	1	2	1	3	3	1	1	2

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

BVVS

UME 729 E	REFRIGERATION AND AIR CONDITIONING	03 - Credits (2 : 2 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	12 Hrs

BRIEF REVIEW OF VARIOUS METHODS OF REFRIGERATION: Vapour compression cycle: Analysis of Vapour Compression cycle using P-H and T-S diagrams- calculations, standard rating of operating conditions, Actual vapour compression cycle, Second law analysis of Vapour Compression Cycle.

REFRIGERANTS:
Types of Refrigerants, Comparative study of Ethane and Methane derivatives, of Refrigerants, Requirements of Refrigerants, Effects of lubricants in Refrigerants, substitutes of CFC Refrigerants, Mixture Refrigerants-azeotropic mixtures.

UNIT – II	12 Hrs

MULTI PRESSURE VAPOUR COMPRESSION SYSTEMS: Multi stage compression, Multi evaporator systems, Cascade systems, calculation, production of solid carbon dioxide, System practices for multistage system.

EQUIPMENTS USED IN VAPOUR COMPRESSION REFRIGERATION SYSTEM: Compressors, Principle, types of compressors, capacity control. Condensers: Types and construction, Expansion devices: Types- Automatic expansion valve, Thermostatic expansion valves, capillary tube. Sizing Evaporator: Types & construction.

UNIT - III	10 Hrs

Diesel fuels: Properties and rating of fuels; cetane number, chemical energy of fuels, reaction equation, properties of A/F mixture, combustion temp, combustion charts. Vapor pressure, cloud and pour point, annealing point, diesel index, carbon residue.

Combustion in CI engines: Stages of combustion, air fuel ratio in CI engines, delay period, variables affecting delay period, diesel knock, methods of controlling diesel knock, CI combustion chambers, open and divided. Induction swirl, turbulent combustion chambers, types, M - combustion chamber.

UNIT IV	14 Hrs

LOAD CALCULATIONS AND APPLIED PSYCHOMETRICS: Internal heat gains, system heat gains, break up of ventilation load and effective sensible heat factor, Bypass factor, cooling load estimate. Psychometric calculations for cooling. Selection of Air conditioning apparatus for cooling and dehumidification, evaporative cooling.

TRANSMISSION AND DISTRIBUTION OF AIR:
Room Air Distribution, Friction loss in ducts, dynamic losses in ducts, Air flow through simple Duct system, Duct design.

CONTROLS IN REFRIGERATION AND AIR CONDITIONING EQUIPMENTS:
High pressure and low pressure cut out, thermostats, pilot operated solenoid valve, motor controls, bypass control-Damper motor. VAV controls.

Reference Books:

1. Principles of Refrigeration' Dossat, Pearson-2006.
2. 'Heating, Ventilation and Air Conditioning' by McQuistion, Wiley Students edition, 5th edition 2000.

3. 'Air conditioning' by PITA, 4th edition, pearson-2005
4. 'Refrigeration and Air-Conditioning' by Manohar Prasad
5. Refrigeration and Air-Conditioning' by C. P. Arora, Tata McGraw Hill Publication, 2nd edition, 2001.
6. Refrigeration and Air-Conditioning' by W. F. Stoecker, Tata McGraw Hill Publication, 2nd edition, 1982.

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

1. Students will demonstrate the ability to understand vapor compression refrigeration and types of refrigerants.
2. Students will demonstrate the ability to understand multistage vapor compression refrigeration system and equipment used in vapor compression refrigeration system.
3. Student will demonstrate the ability to understand vapor absorption system and psychrometric of air conditioning
4. Students will demonstrate the ability to understand load calculations and applied psychrometric chart transmission and distribution of air, controls in refrigeration and air conditioning equipment's

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 carries 20 marks and should not have more than 4 subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
1	1	2	1	1	3	1	2	2	3	1	1	1
2	3	2	3	--	1	2	--	1	3	2	3	2
3	1	1	2	1	1	3	--	1	2	2	3	1
4	3	2	3	2	3	1	2	--	3	1	2	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 730 E	Operation Management	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

Introduction: Functional subsystems of organization, System concept of production, Types of production system, Productivity, strategic management, World class manufacturing.

Product Design and Analysis: New product development concepts, Process planning and design, Value analysis/Value engineering, Make or buy decision, Ergonomic consideration in product design

UNIT – II	10 Hrs

Forecasting: Nature and use of forecasting, Sources of data, Demand patterns, Factors affecting forecast, types of forecasting, Forecasting Models – Linear Regression, Simple moving average, weighted moving average, e, Single exponential smoothing, Double exponential smoothing, Adjusted exponential smoothing and Delphi method.

Facility Location: Introduction, factors influencing plant location, break even analysis, single facility location problem, Minimax location problem and gravity location problem.

UNIT - III	10 Hrs

Plant Layout and Materials Handling: Introduction, Classification of layout, Layout design procedures – Computerized Relative Allocation of Facilities Technique (CRAFT), Automated Layout Design Program (ALDEP) and, Computerized Relationship Layout Planning (CORELAP).

Line Balancing: Concept of mass production system, objective of assembly line balancing, rank positional weight method and the COMSOL Algorithm.

UNIT IV	10 Hrs

Modern Production Management Tools: Just-In-Time manufacturing – introduction and overvies of JIT, basic principles, push/pull production, kanban systems (pull systems). Total Quality Management – scope of TQM, benefits of TQM, quality control activities during product cycle, operating quality costs. Kaizen – Key elements of kaizen, classification of kaizen, steps of implementation of kaizen Blitz, guidelines of kaizen team, benefits of kaizen. Lean Manufacturing – steps of lean manufacturing, components of lean manufacturing.

Reference Books:

1. Modern Production/Operations Management, Buffa, Wiley Eastern Ltd.2001
2. Operations Management, Joseph G MonksMc Graw Hill 1987.
3. Production and Operations Management, R. Panneerselvam. Prentice Hall of India Pvt Ltd. 2005.
4. Analysis and Control of Production Systems, 2nd Edition, Elsayed A. Elsayed, Thomas O. Boucher, Pearson, 1994
5. Production and Operations Management, R. B. Khanna, PHI, 2010.

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

1. Students will demonstrate the ability to understand vapor compression refrigeration and types of refrigerants.
2. Students will demonstrate the ability to understand multistage vapor compression refrigeration system and equipment used in vapor compression refrigeration system.

3. Student will demonstrate the ability to understand vapor absorption system and psychrometric of air conditioning
4. Students will demonstrate the ability to understand load calculations and applied psychrometric chart transmission and distribution of air, controls in refrigeration and air conditioning equipment's

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 carries 20 marks and should not have more than 4 subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
1	1	2	1	1	3	1	2	2	3	1	1	1
2	3	2	3	--	1	2	--	1	3	2	3	2
3	1	1	2	1	1	3	--	1	2	2	3	1
4	3	2	3	2	3	1	2	--	3	1	2	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 705 L	**CAE LABORATORY**	**01 - Credits (0 : 0 : 2)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I

1. Study of a FEA package and stress analysis of
2. Trusses – (Minimum 2 exercises).
3. Beams – Simply supported, cantilever beams with UDL and with varying load.

UNIT – II

1. Stress analysis of a rectangular plate with a circular hole.
2. Thermal Analysis – 2D problem with conduction and convection boundary conditions.
3. Fluid flow Analysis – Potential distribution in the 2D bodies.
4. Dynamic Analysis
   1) Fixed – fixed beam for natural frequency determination.
   2) Bar subjected to forcing function.
   3) Fixed – fixed beam subjected to forcing function.

REFERENCE BOOKS:

1. A first course in the Finite element method by Daryl L Logan, Thomason, Third Edition.
2. Fundaments of FEM by Hutton – McGraw Hill, 2004.
3. Finite Element Analysis by George R. Buchanan, Schaum Series.

Scheme for Examination:

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.

1. To demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-Purpose software;
2. To model multi-dimensional heat transfer, flow analysis, model problems and harmonic problems using ANSYS;
3. To demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purpose;
4. To develop a basic understanding of the limitations of the FE method and understand the possible error sources in its use.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
1	**3**	**1**	**1**	**2**	**1**	**3**	**3**	**3**	**3**	**3**	**1**	**3**
2	**3**	**2**	**2**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**3**	**3**
3	**2**	**1**	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**
4	**1**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 705 L	**CNC LABORATORY**	**01 - Credits (0 : 0 : 2)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Part-A

1. Programming on lathe for facing
2. Programming on lathe for simple turning
3. Programming on lathe for step turning
4. Programming on lathe for groove cutting

Part-B

5. Programming on milling with drill tap attachment for facing
6. Programming on milling with drill tap attachment for drilling
7. Programming on milling with drill tap attachment for tool path movement

Scheme for Examination:

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.

1. Understand the basic procedures and concepts of programming, set up and operation of a CNC Machining Center.
2. Identify and understand the basic programming codes.
3. Create geometry and tool paths from the specifications for simple parts
4. Identify and define the functions of the CNC machine control.
5. Set up the CNC machining center for manufacturing simple parts
6. Manufacture simple parts on the CNC machining center.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
1	2	3	3	3	3	1	2	1	3	2	2	3
2	3	3	3	3	3	1	1	2	3	3	3	3
3	2	2	2	2	1	1	2	1	3	1	2	1
4	3	3	3	2	3	3	1	3	3	2	3	2

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 711 P	**PROJECT PHASE I**	**05 - Credits (0 : 0 : 6)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

5 Credits (5 days, daily 2 Hours)

Course Objective and outcomes:

The explore the problems in the society ,Industry, Agriculture etc and plan and design the solution

- Literature Survey
- Project problem definition
- Submission of project proposal

Scheme of examination

CIE – 50 Marks

SEE – 50 Marks Presentation Viva-voce

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
1	1	1	1	1	1	1	1	1	1	1		
2	1	2	2	2	1	2	2	2	1	2		
3	2	2	1	2	2	2	1	2	2	2		
4	1	1	2	1	1	1	2	1	1	1		

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

Department of Mechanical Engineering

Scheme Autonomous Syllabus (175 credits)

B.E. VIII SEMESTER

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1.	UME 8XX E	Dept Elective - V	2	2	-	-	50	50	100
2.	UME 8XX E	Dept Elective - VI	3	3	-	-	50	50	100
3.	UME 8XX E	Dept Elective - VII	3	3	-	-	50	50	100
4.	UME 809 P	Project Phase-II	12	-	-	24	50	50	100
5.	UME 832 S	Technical Seminar	1	-	-	2	50	50	50
		Total Credits	**21**	**09**	**-**	**26**	**250**	**250**	**500**

Electives offered by the Department

The students have to register for any two subjects from Group – I, II, III and any one subject from Group IV.

Group – I (Cr 3)	Group – II (Cr 3)	Group – III (Cr 3)	Group – IV (Cr 2)
UME 833 E: Advanced Metal Joining Processes UME 834 E: Product Design & Rapid Prototyping UME 828 E: Information Technology Approaches in Manufacturing	UME 835 E: Theory of Elasticity UME 821 E: Design of Mechanism	UME 811 E: Hydraulics and Pneumatics UME 830 E: Non Conventional Energy resources UME 836 E: Computational Fluid Dynamics	UME 829 E: Reliability Engineering and Experimental Design. UME 831 E: Supply Chain Management

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 833 E	**ADVANCED METAL JOINING PROCESSES**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Distortion, methods to avoid distortion. Stresses in Joint Design, Welding and Cladding of dissimilar materials, concepts and metallurgical problems in dissimilar metal welding / joining. Electro Slag, Welding Electron Beam Welding, Plasma arc Welding, Laser Beam Welding, Explosion Wel Welding, Ultrasonic Welding, Friction welding and Thermit welding,	
UNIT – II	**10 Hrs**
Advanced brazing processes, different types: conventional brazing, active metal brazing, furnace brazing. Advantages, disadvantages. Welding of plastics: principle, common weld able plastics, heated tool welding, hot gas welding, high frequency welding, and ultrasonic welding. Inspection of Welds: Destructive techniques like Tensile, Bend, Nick break, Impact & Hardness. Non-Destructive techniques like 'X' rays, Ultrasonic, Magnetic particle, Dye Penetrant, Gamma ray inspection.	
UNIT - III	**10 Hrs**
Welding Symbols-Need for, Representing the welds, Basic weld symbols, Location of Weld, Supplementary symbols, Dimensions of welds, Examples Welding Introduction, Principles of sound welding design, Welding joint design. Welding positions, Allowable strengths of welds, under steady loads.	
UNIT IV	**10 Hrs**
Quality Control in Welding - Introduction, Quality assurance v/s Quality control, Weld quality, Discontinuities in welds, their causes and remedies and Quality conflicts. Computer-Aided Welding Design: Introduction. Principles of sound welding design, Wilding joint design. Welding positions. Allowable strengths: of welds .under steady loads. Weld throat thickness.	

Reference Books:

1. Welding Engineering Hadbook by A.W.S.
2. Welding Engineering by Rossi.
3. Advanced Welding processes - Nikodaco&Shansky MIR Publications. .
4. Welding Technology by O.P. Khanna.
5. Welding for engines byUdin, funk & Wulf
6. Welding and welding technology- R.L Little.

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

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 carries 20 Marks and should not have more than 4 subdivisions

3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2	2	1	1	2	2	1	1	2		
2	2	1	1	1	2	1	1	1	2	1		
3	1	1	2	1	1	1	2	1	1	1		
4	1	1	1	2	1	1	1	2	1	1		

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 834 E	**Product Design and Rapid Prototyping**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Introduction : Definition , importance of PD, Objectives of PD,essential requirements of PD, who designs product, Project team, steps in new PD, Characteristics of successful product development, duration and cost of product development , challenges of product development, Design for manufacture, re-manufacturing , sequential and concurrent engineering . **Design for manufacture & assembly:** Design for Manufacture and Assembly, History , Implementation of Design for Assembly , Design for Manufacture , How Does DFMA Work, Advantages of Applying DFMA during Product Design design for Maintainability, Design for Environment Design for safety, Vision and Illumination design	
UNIT – II	**10 Hrs**
Development processes and organizations: A generic development process, Usefulness of a well-defined Development Process, task & responsibilities for marketing, design and manufacturing , concept development: the front end process, adopting the generic product development process, process flow diagram for variant of products, product development organizations (functional, project & matrix)	
UNIT - III	**10 Hrs**
Introduction to RP **Prototype fundamentals**,definition of Prototypes, types of prototypes, need for the compression in product development, RP fundamentals , RP wheel, history of RP systems, applications of RP, growth of RP industry, basic principle of rapid prototyping processes, classification of RP systems . advantages and disadvantages of rapid prototyping. **Stereolithogrphy systems:** principle, process details , advantages and disadvantages, applications	
UNIT IV	**10 Hrs**
Selective Laser sintering: principle, process details , advantages and disadvantages, applications **Fused deposition modeling**: principle, , process details , advantages and disadvantages, applications **Laminated object manufacturing :** principle, process details, LOM materials advantages and disadvantages, applications **Solid Ground curing:** principle of operation , machine details, advantages and disadvantages, applications	
Reference Books: 1. The design of everyday things by Don Norman 2. Product designs from concept to Manufacture by Jennifer Hudson 3. Additive manufacturing by Brent Stucker, David W. Rosen, and Ian Gibson 4. Engineering design and rapid prototyping by Ali K. Kamrani and Emad Abouel Nasr 5. Product design & development by Karl T Ulrich and Steven D Eppinger 6. Rapid Prototyping principles and applications by C K Chua, K F Leong and C S Lim	

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

1. Express basics of product design as a means to manage the development of an idea from concept to production
2. Analyze evaluate and apply the generic method for product development
3. Evaluate basics of prototyping
4. Demonstrate Stereolithogrphy , selective laser sintering , fused deposition modeling , laminated object manufacturing & solid ground curing

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	1	1	1	1	1	1	1	1	1	1	2	1
2	2	1	1	2	1	2	2	1	3	2	2	1
3	1	3	1	1	1	1	2	1	1	1	1	1
4	3	3	1	2	1	2	1	1	3	2	2	1

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 828 C	**INFORMATION TECHNOLOGY APPROACH IN MANUFACTURING**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Information Technology and the Increasing Complexity of Manufacturing: Introduction, Information Technology for Manufacturing- Definition and Elements, Flexibility for the future, Recognizing Information Technology's Increasing Capability in a Changing World, New Manufacturing Styles. **IT Systems:** Computer Hardware- Fundamentals, Classification of Computers, Design Workstations, Principles of Networking, Private Computer Communication Networks, (VPN, PSDN,ISDN), Network Topologies, Transmission Media, Intranet, Internet.	
UNIT – II	**10 Hrs**
Introduction to CIM Database: Database requirements of Manufacturing, Database, Features of Database Management System, Database Models-Hierarchical, Network and Relational, DBMS architecture, Query Language. SQL as a knowledge base query language. **Product Data Exchange:** Introduction, Types of Translators, IGES, STEP, ACIS and DXF, Processors, Case Study on STEP.	
UNIT - III	**10 Hrs**
Concurrent Engineering: Introduction, Implementation of concurrent engineering,Concurrent engineering and Information Technology, Soft and Hard prototyping, Characteristics of Concurrent Engineering, Key factors influencing the success of CE, Examples of CE. **Collaborative Design:** Introduction, Distributed Computing, Intranets and Extranets, Instant Messaging, Virtual Reality Modeling Language, Traditional Design, Collaborative Design, Collaborative Principles,Collaborative approaches, Collaboration Tools, Collaborative Design Systems.	
UNIT IV	**10 Hrs**
Planning of Resources for Manufacturing through Information Systems: Introduction, Role of MRP-II in a CIM system, Manufacturing Applications, Engineering Applications, Dynamic Enterprises, ERP, SCM, Selection of an ERP package, ERP in India, Dynamic Enterprise Modelling (DEM). **IoT:** IoT Overview, IoT Hardware, Iot Software, IoT Technology and Protocols, IoT Common Uses, IoT Manufacturing Applications, Energy applications.	
Reference Books: 1. Internet of Things, www.tutorialpoint.com 2. https://www.nap.edu/read/4815/chapter/1 3. Radhakrishnan, Subramanyan, V. Raju, "CAD/CAM/CIM", NewAge International Publishers, Third Edition. 4. Mikell P. Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", Prentice-Hall of India Pvt. Ltd. Second Edition. 5. Ibrahim Zeid, "Mastering CAD/CAM", Tata McGraw-Hill Publishing Company Ltd.	

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

1. Understand and identify the manufacturing sector with the application of Information Technology theory and tools. Learn the IT system ingredients to understand concepts, specifications, and applications.
2. Understand the method of transforming the design and manufacturing information into data, identify the classification and application of different data management methods.
   gain knowledge of Query language and knowledge of handling manufacturing data using different types of file systems.
3. Study the role of Information Technology in manufacturing sequences comprising of various production activities. Apply the concepts of concurrent engineering, collaborative design in manufacturing network.
4. Apply the concept of the ERP in manufacturing; understand the concept of IoT and its applications.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2	2	1	2	1	2	2	3	2	1	
2	2	2	1	1	1	1	2	1	2	1	2	2
3	2	1	2	1	1	3		1	2	2	1	1
4	2	2	2	3	1	1	2		2	1	1	

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 835 E	THEORY OF ELASTICITY	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

DEFINITIONAND NOTATION: Stress, Stress at a Point, Equilibrium Equations, Principal Stresses, Mohr's Diagram, Maximum Shear Stress, Boundary Conditions.

STRAIN AT A POINT: Compatibility Equations, Principal Strains, Generalized Hooke's law, Methods of Solution of Elasticity Problems – Plane Stress-Plane Strain Problems.

UNIT – II	10 Hrs

TWO DIMENSIONAL PROBLEMS: Cartesian co-ordinates – Airy's stress functions – Investigation of Airy's Stress function for simple beam problems – Bending of a narrow cantilever beam of rectangular cross section under edge load – method of Fourier analysis – pin ended beam under uniform pressure.

GENERAL EQUATIONS IN CYLINDRICAL CO-ORDINATE: Thick cylinder under uniform internal and / or external pressure, shrink and force fit, stress

UNIT - III	10 Hrs

STRESSES IN AN INFINITE PLATE: Stress in infinite plate with a circular hole subjected to uniaxial and biaxial loads, stress concentration, stresses in rotating discs and cylinders.

TORSION OF CIRCULAR, ELLIPTICAL AND TRIANGULAR BARS: Torsion of circular, elliptical and triangular bars, membrane analogy, torsion of thin open sections and thin tubes.

UNIT IV	10 Hrs

THERMAL STRESSES: Thermo elastic stress strain relationship, Equations of equilibrium Thermal stresses in thin circular discs.

UNIQUENESS THEOREM: Principle of super position, reciprocal theorem, Saint Venant principle.

Reference Books:

1. Applied Elasticity-C.T. Wang-Tata Mc. Graw Hill-1953
2. Theory of Elasticity -Sadhu Singh-Khanna Publishers-1997.
3. Elasticity in Engineering Mechanics, , -A. P. Boresi and K. P. Chong- John Wiley &Sons-2nd Edition, 2000.
4. Advanced Strength and Applied Elasticity.-A. C. Ugural and S. K. Fenster-Elsevier-2nd Edition, 1987.
5. Theory of elasticity -T.G.Sitaram-Springer-2021
6. Advanced Mechanics of solids -L. S. Srinath-Tata Mc. Graw Hill-2003
7. Theory of Elasticity-S. P. Timoshenko and J. N Goodier-Tata Mc. Graw Hill-2006
8. Elasticity: Theory, Applications and Numeric's-Martin H. Sadd,-Academic Press, -2010

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

1. Understand the basic concepts in continuum mechanics of solids, including of strain, internal force, stress and equilibrium in solids
2. Understand and solve the basic problems of the theory of elasticity by using Airy function expressed as biharmonic function. And in polar coordinate system.

3. Understand and solve torsion problems in bars and thin walled members.
4. Understand index notation of equations, tensor and matrix notation applied to thermal stresses.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	3	2	2	2	2	1	1	2	1	1	1	3
2	3	2	3	2	2	2	1	1	1	1	1	2
3	2	3	2	2	2	1	2	2	1	1	1	1
4	2	2	3	2	2	1	2	1	1	1	1	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 821 E	DESIGN OF MECHANISMS	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs

Geometry of motion: Introduction, analysis and synthesis, mechanism terminology, planar, spherical and spatial mechanisms, mechanical advantage, equivalent mechanisms, unique mechanisms.

Generalized principles of dynamics: Fundamental laws of motion, generalized coordinates, configuration space, constraints, virtual work, principle of virtual work, energy and momentum, work and kinetic energy, equilibrium and stability, kinetic energy of a system, angular momentum

UNIT – II	10 Hrs

Lagrange's Equation: Larange's equation from D.Alembert's principles, examples, Hamiltons equations, Hamiltons principle, Lagrange's equation from Hamiltons principle, derivation of Hamiltons equations, examples.

Synthesis of linkages: Type, number, and dimensional synthesis, function generation, path generation and body guidance, Precision positions, structural error, Chebychev spacing, two position synthesis of slider crank mechanisms, crank-rocker mechanisms with optimum transmission angle.

UNIT - III	10 Hrs

Motion generation: Poles and relative poles, relative poles of 4-bar mechanism, relative poles of slider crank mechanism.

Graphical methods of dimensional synthesis: Two position synthesis of crank and rocker mechanisms, three position synthesis, four position synthesis (point precision reduction), overlay method, coupler curve synthesis, cognate linkages.

UNIT IV	10 Hrs

Analytical methods of dimensional synthesis: Freudenstein's equation for four bar mechanism and slider crank mechanism, examples, Bloch's method of synthesis.

Cams: Introduction, pressure angle, parameters affecting pressure angle, effect of offset follower motion, radius of curvature and undercutting, cams with specified contours.

Reference Books:

1. 'Mechanism & machine Theory', A.G. Ambekar, PHI, 2007
2. 'Kinematics, Dynamics & Design of Machinery', K. J. Waldron, G. L. Kinzel, Wiley India, 2007.
3. 'Design of Machinery', R. C. Nortan , Tata McGraw Hill
4. "Theory of Machines and Mechanism", E. Shigley, J. J. Uicker, McGraw Hill Company.
5. "Classical Dynamics", Greenwood, Prentice Hall of India, 2004

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

1. Analyze and design mechanisms to create arbitrary motion.
2. Know the position synthesis of planar mechanism.
3. Design the planar mechanisms both analytical and by graphical solutions.
4. Design and construct a working mechanism in small teams and to document the design in a detailed report

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 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.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	2	2	2	2	1	1	2	1	1	1	3
2	3	2	3	2	2	2	1	1	1	1	1	2
3	2	3	2	2	2	1	2	2	1	1	1	1
4	2	2	3	2	2	1	2	1	1	1	1	2

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 811 C	**HYDRAULICS AND PNEUMATICS**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Introduction to Hydraulic Power: Pascal's law, The Source of Hydraulic Power: Pumps Pumping theory, pump classification, gear pumps, vane pumps, piston pumps, pump performance, variable displacement pumps. **Hydraulic Actuators and Motors:** Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinde Hydraulic Rotary Actuators, Gear motors, vane motors and piston motors.	
UNIT – II	**10 Hrs**
Control Components in Hydraulic Systems: Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves. **Maintenance of Hydraulic systems:** Hydraulic oils – Desirable properties, general type of fluids, sealing reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving part particle contamination, temperature control, trouble shooting.	
UNIT - III	**10 Hrs**
Hydraulic Circuit Design and Analysis: Control of single and Double – acting Hydraulic cylinder, regenerative circuit, pump unloading circuit, Double pump Hydraulic system, Counter Balance Valve application, Hydraulic cylinder sequencing circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control of hydraulic cylinder, speed control of hydraulic motors, accumulators and accumulator circuits.	
UNIT IV	**10 Hrs**
Neumatic Controls: Choice of working medium, characteristics of compressed air,.preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout. Pneumatic Actuators: Linear cylinders – Types, conventional type of cylinder working, end position cushioning, seals. Rod – less cylinders – types, working advantages. Rotary cylinder types construction. **Directional Control valves:** Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve. **Simple Pneumatic Control:** Direct and indirect actuation pneumatic cylinders. Flow control valves and of cylinders supply air throttling and exhaust air throttling use of quick exhaust valve.	
Reference Books: 1. Oil Hydraulic Systems - Principles and Maintenance, S.R. Majumdar, Tata Mc Graw Hill publish company Ltd. 2001. 2. Pneumatic Systems, S.R. Majumdar, Tata Mc Graw Hill publishing Co., 1995. 3. Industrial Hydraulics, Pippenger, Hicks, McGraw Hill, New York. 1. Fluid Power with applications, Anthony Esposito, Fifth edition pearson education, Inc. 2000. 4. Pneumatics and Hydraulics, Andrew Parr. Jaico Publishing Co.2000.	

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

1. Understand the basics of Hydraulics and pneumatics
2. Describe various components of hydraulic system and maintenance of hydraulic system for various applications
3. Design hydraulic and pneumatic system for various applications

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2	--	2	--	--	--	--	--	--	--	1
2	2	1	1	1	--	2	2	3	1	3	2	1
3	1	2	1	1	--	2	1	2	2	3	1	--
4	--	--	--	--	--	--	--	--	--	--	--	--

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 830 E	NON-CONVENTIONAL ENERGY	03 - Credits (3 : 0 : 0)
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs
Introduction: Energy sources, need for non-conventional energy sources, energy alternatives, advantages and disadvantages. **Solar Radiation:** Extra-Terrestrial radiation, solar constant, beam, diffuse and global radiation, Measurement of Solar Radiation: Pyranometer, shading ring pyrheliometer, sunshine recorder, principle of working.	
UNIT – II	**10 Hrs**
Solar Radiation Geometry: Solar time, latitude, declination angle, altitude, surface azimuth angle, hour angle, zenith angle, angle of incidence, day length, problems on day length. **Solar Thermal Conversion:** Collection and storage, thermal collection devices, liquid flat plate collectors, concentrating collectors (cylindrical, parabolic, paraboloid) power generation.	
UNIT - III	**10 Hrs**
Wind Tidal and Ocean Thermal Energy: Wind power: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis windmills. **Tidal power:** Fundamental characteristics of tidal power, harnessing tidal energy, limitations. **Ocean Thermal Energy Conversion:** Principle of working, problems associated with OTEC.	
UNIT IV	**10 Hrs**
Biogas Hydrogen Fuel cell and Photovoltaic: Biogas production from waste biomass, Use of biogas in IC engines, advantages of anaerobic digestion, floating drum (constant pressure) type, fixed dome (constant volume) type biogas plants, comparison. **Hydrogen:** Hydrogen as energy carrier, storage, conversion, applications and safety. **Fuel cell:** Principle of working, Types, Salient features of each fuel cell, applications. **Photovoltaic:** Solar photovoltaic systems, advantages, disadvantages and applications.	
Reference Books: 1. Non-Conventional Energy System-S K Agarwal-APH Publishing Corporation- 2005 2. Non-conventional Energy Systems-K. M. Mital-A H Wheeler Publishing Co Ltd-1999 3. Non-Conventional Energy Source and Utilization -R K Rajput-S Chand &Company-2014 4. Non-Conventional Energy Resources -B.H. Khan-McGraw Hill Education India Private Limited-3rd edition, 2017 5. Solar energy -Subhas P Sukhatme-Tata McGraw Hill -2nd Edition, 1996 6. Non-Conventional Energy Sources -G.D Rai -Khanna-2nd Edition1988	

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

1. Know the conventional and non-conventional energy sources, measurement of solar radiation.
2. Understand solar radiation geometry and various solar thermal devices
3. Know importance of wind energy, tidal energy and ocean thermal energy conversion system.
4. Know about the production of biogas, advantages, Hydrogen energy and its applications, photovoltaic and fuel cells

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2	2	2	2	1	2	2	2	2	1	--
2	2	2	2	1	1	1	2	1	3	1	3	2
3	1	1	2	1	1	3	--	1	2	2	1	1
4	3	2	3	2	1	1	2	--	3	1	2	--

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 836 E	**Computational Fluid Dynamics**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
Introduction: Introduction to computational fluid dynamics, advantages, limitations and applications. **CFD solution procedure:** Preprocessor: Selection of computational domain, selection of flow model, grid generation, fluid properties and flow variables. Solver: Discretization of governing equations, solutions of governing equations. Post processor: various post processing methods.	
UNIT – II	**10 Hrs**
Governing equations: Continuity equation, momentum equation, energy equation, physical boundary conditions, introduction to turbulence and standard k-ε turbulence model.	
UNIT - III	**10 Hrs**
Classification: Classification of partial differential equations, general behavior of different classes of partial differential equations, well posed problems. **CFD Techniques:** Discretisation of governing equations, finite difference method, finite volume method, converting governing equations to algebraic equation system, implicit and explicit approaches.	
UNIT IV	**10 Hrs**
CFD solution methods: Central difference and upwind schemes applied to 1-D situation involving convection and diffusion terms, Maccormack's technique applied to unsteady 2-D inviscid flow, pressure velocity coupling (SIMPLE scheme applied to incompressible viscous flow). **Numerical solution of algebraic equations:** Direct and iterative methods, Thomas algorithm, Jacobi and Gauss - Siedel methods. **CFD solution analysis**: Consistency, stability, convergence, accuracy and efficiency, sources of solution errors, verification and validation.	

Reference Books:

1. Computational Fluid Dynamics-A Practical Approach-JiyuanTu, Guan HengYeoh, and Chaoqun Liu,-Butterworth-Heinemann-2008,
2. Fundamentals of Computational Fluid Dynamics-Tapan K. Sengupta,-Universities Press Private Ltd.-**2005**
3. Computational Fluid Dynamics for Engineers-Tuncer Cebeci, Jian P. Shao, FassiKafyeke and Eric Laurendeau,-Horizons Publishing-**2005**
4. "Computational Fluid Dynamics"-John D. Anderson,-McGraw Hill,-2013

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

1. *Define* the need, advantages , disadvantages and steps involved in CFD
2. *Apply* the governing equations of fluid flow to *compile* the scope and applicability of equations.

3. *Analyze* the governing equations of fluid flow using finite difference/finite volume method.
4. *Analyze* the fluid flow computational solutions and methods to *compile* the CFD solutions.

Question paper pattern for SEE:

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

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	2	2	1	1	--	--	1	--	3	--	1
2	2	2	2	2	1	--	--	1	--	2	--	1
3	2	1	2	2	2	--	--	--	--	3	--	3
4	2	1	3	3	3	2	--	--	--	--	1	--

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 829 E	**RELIABILITY ENGINEERING AND EXPERIMENTAL DESIGN**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**
BASICS OF RELIABILITY: Reliability: Definition and basic concepts of Reliability; Life-cycle curve and Probability distributions in modeling; Probability distributions to model failure rate; System Reliability: Systems with components in series; Systems with components in parallel; Systems with components in series and parallel; Systems with standby components.	
UNIT – II	**10 Hrs**
RELIABILITY AND LIFE TESTING PLANS: Operating characteristics curves; Types of tests; Failure-terminated test; Time-terminated test; Sequential reliability testing; Life testing plans using the exponential distribution; Standard life testing plans using Handbook H 108.	
UNIT - III	**10 Hrs**
EXPERIMENTAL DESIGN: Introduction; Experimental design fundamentals; Some experimental design; Completely randomized design; Randomized block design; Latin square design; Factorial experiments; Two-factor factorial experiment; Role of contrasts; The 2k factorial experiment.	
UNIT IV	**10 Hrs**
THE TAGUCHI METHOD: The Taguchi philosophy; Loss function; Signal-to-Noise-Ratio and Performance measures; Critique to S/N Ratios; Experimental design in the Taguchi Method; Orthogonal arrays and linear graphs; Estimation of effects; Parameter design in Taguchi method; Critique to experimental design and the Taguchi Method	

Reference Books:

1. Introduction to Reliability Engineering by Dhilan& Singh
2. Robust design by Sunil Phadike
3. Fundamentals of Quality Control and Improvement by Amitava Mitra, Prentice Hall of India New Delhi
4. 2. Probability, Statistics and Random Processes by T Veerarajan, Tata McGraw-Hill New Delhi

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

1. To have the knowledge about role of reliability engineering in systems design and analysis
2. To understand the concept of life testing plans and apply them to engineering components
3. To apply the Experimental design concepts in design and development of engineering products
4. To know the principles of Taguchi method and apply them to engineering concepts.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1	1	3	2	1	3	--	--	--	--	--	--	--
2	1	1	3	1	1	--	--	--	--	--	1	--
3	2	2	2	1	3	--	--	--	--	--	3	--
4	1	1	2	2	2	--	--	--	--	--	3	--

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 831 E	**SUPPLY CHAIN MANAGEMENT**	**03 - Credits (3 : 0 : 0)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs**

Framework of Supply Chains: Introduction to supply chain, The objective of a supply chain, The importance of supply chain decisions, Decision phases in a supply chain, Process views of a supply chain: Cycle view of supply chain processes, Push/Pull view of supply chain processes, Examples (minimum two) of Supply Chains.

Performance of Supply Chains: Competitive and supply chain strategies, Achieving strategic fit: Understanding the customer and supply chain uncertainty, Understanding the supply chain capabilities, Achieving strategic fit, Issues affecting strategic fit, Expanding strategic scope, Drivers of supply chain performance, Framework for structuring drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing.

UNIT – II	**10 Hrs**

Designing the Supply Chain Network: The role of distribution in the supply chain, Factors influencing distribution network design, Design options for a distribution network: Manufacturer storage with direct shipping (MSWDS), MSWDS and in-transit merge, Distributor storage with package carrier delivery, Distributor storage with last-mile delivery, Manufacturer or Distributor storage with customer pick-up, Retail storage with customer pickup, Selecting a distributor network design.

Transportation in a Supply Chain: The role of transportation in a Supply Chain, Modes of transportation, Design options for a transportation network: Direct shipment network, Direct shipping with milk-runs, All shipments via central-DC, Shipping via DC using milk-runs, Tailored network, Tailored transportation: By customer density and distance, By size of customer, The Role of IT in transportation, Risk management in transportation, Making transportation decisions in practice.

UNIT - III	**10 Hrs**

Demand forecasting in a Supply Chain: The role of forecasting in a supply chain, Characteristics of forecasts, Components of a forecast and forecasting methods, Basic approach to demand forecasting, The role of IT in forecasting, Risk management in forecasting, Forecasting in practice.

Sourcing and Cross-Functional Drivers in a Supply Chain: The role of sourcing in a supply chain, In-house or Outsource, Risks of using a Third-party, Supplier scoring and assessment, The procurement process, Sourcing planning and analysis, The Role of IT in Sourcing, Risk Management in Sourcing, Making Sourcing Decisions in Practice.

UNIT IV	**10 Hrs**

Information Technology in a Supply Chain: The Role of IT in a supply chain, The supply chain IT framework, Customer Relationship Management (CRM), Internal supply chain management, Supplier Relationship Management (SRM), The Transaction Management Foundation, The future of IT in the supply chain, Risk Management in IT, Supply Chain IT in Practice.

Coordination in a Supply Chain: Lack of Supply Chain Coordination and the Bullwhip Effect, The Effect on performance of lack of coordination, Obstacles to coordination in a supply chain, Managerial levers to achieve coordination, Building strategic partnerships and trust within a supply chain, The Role of IT in Coordination, Achieving Coordination in Practice

Reference Books:

1. Supply Chain Management–Strategy, Planning & Operation. -Sunil Chopra, Peter Meindl & D V Kalra-Pearson Prentice Hall (Education, South Asia)-Third Edition 2007
2. Supply Chain Redesign–Transforming Supply Chains into Integrated Value Systems.-Robert B Handfield, Ernest L Nichols, Jr-Pearson Education/Financial Times Prentice Hall PTR-2002
3. Sustainable Logistics and Supply Chain Management: Principles and practices for sustainable operations and management-David B Grant, Alexander Trautrims and Chee Yew Wong-Kogan Page Limited-Second edition
4. Purchasing and Supply Chain Management: Strategies and Realities-Michael Quayle-IRM Press-2006

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

1. Demonstrate the supply chain objectives, importance, decision phases, process views, performance with strategic fit and their impact on success of a supply chain.
2. Develop a distribution network with different modes of transportation, understanding the effect of e-business on the design of distribution networks in different industries.
3. Express the role of forecasting and sourcing with their risk management.
4. Analyze technology and coordination in a supply chain, applications of IT for supply chain drivers and the processes that enable supply chain performance.

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 carries 20 Marks and should not have more than 4 subdivisions
3. Any five full questions are to be answered choosing at least one from each unit.

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	--	--	1	--	--	--	--	--	--	--	--	1
2	--	--	--	1	1	--	--	--	--	1	--	1
3	1	--	--	1	1	--	--	--	--	--	--	1
4	--	--	--	--	3	--	--	--	--	--	--	1

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOTE- 587 102

MECHANICAL ENGINEERING

UME 811 P	**PROJECT PHASE II**	**10 - Credits (0 : 0 : 6)**
Hrs./Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

5 Credits (5 days, daily 2 Hours)

Course Objective and outcomes:

The explore the problems in the society ,Industry, Agriculture etc and plan and design the solution

- Literature Survey
- Project problem definition
- Submission of project proposal
- Submission of Project model

Scheme of examination

CIE – 50 Marks

SEE – 50 Marks Presentation Viva-voce

Table: Matrix to describe the mapping of POs with Cos

Course Outcomes (COs)	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
1	1	1	2	1	1	1	2	1	1	1	2	1
2	1	2	1	1	1	2	1	1	1	2	1	1
3	2	1	1	2	2	1	1	2	2	1	1	2
4	1	1	2	1	1	1	2	1	1	1	2	1

Annexure - II

Basaveshwar Engineering College, (Autonomous), Bagalkot
Department of Mechanical Engineering
Abstract of Scheme for B.E. Mechanical from Academic Year 2020 - 21
1st Year – 40 Credits
Higher Semester – 135 Credits
Distribution of Credits (Total Credits – 175)

SL. No.	Sub Type	Credits								
		1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total
1	HSS	-	-	-	1	4	4	-	-	**9**
2	Basic Science (PCM)	9.5	9.5	3	3	-	-	-	-	**25**
3	Engineering Science	10.5	10.5	-	-	-	-	-	-	**21**
4	Professional Core	-	-	15	17	13	15	8	-	**68**
5	Professional Elective	-	-	-	-	2	-	9	9	**20**
6	Open Elective	-	-	-	-	3	3	3	-	**9**
7	Project/ Internship/Seminar	-	-	-	-	-	2*	3^{+}+$2^{\bullet}$	12^{++}+1°	**20**
8	Online Courses	-	-	1	1	1	-	-	-	**3**
Semester Total		**20**	**20**	**19**	**22**	**23**	**24**	**25**	**22**	**175**

* Mini Project
\+ Final year project phase-I
++ Final year project phase-II
• Internship
° Seminar

Basaveshwar Engineering College, Bagalkot
Department of Mechanical Engineering
Academic Year 2020 – 2021 Even Semester

1st Semester (175 Credits Regular) – PHYSICS GROUP

Sl. No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
1	UMA161C	Engineering mathematics-II	4	3	2	-	50	50	100
2	UPH162C	Engineering Physics	4	3	2	-	50	50	100
3	UME163C	Elements of Mechanical Engineering	3	2	2	-	50	50	100
4	UEE164C	Basic Electrical Engineering	3	2	2	-	50	50	100
5	UCS165C	Programming with C	3	3	-	-	50	50	100
6	UHS126M	Constitution of India*	-	2	-	-	50	50	100
7	UPH166L	Engineering Physics Laboratory	1.5	-	-	3	50	50	100
8	UCS167L	C Programming Laboratory	1.5	-	-	3	50	50	100
Total Credits :			**20**	**15**	**8**	**6**			

1st Semester (175 Credits Regular) – CHEMISTRY GROUP

Sl. No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
1	UMA161C	Engineering Mathematics-II	4	3	2	-	50	50	100
2	UCH168C	Engineering Chemistry	4	3	2	-	50	50	100
3	UEC169C	Basic Electronics	3	2	2	-	50	50	100
4	UCV170C	Engineering Mechanics	3	2	2	-	50	50	100
5	UBT133M	Environmental Studies*	-	2	-	-	50	50	100
6	UME171L	Computer Aided Engineering Graphics	2.5	1	-	3	50	50	100
7	UCH172L	Engineering Chemistry Laboratory	1.5	-	-	3	50	50	100
8	UBE173L	Basic Engineering Laboratory	2	-	-	4	50	50	100
9	UHS174K	English for Engineers	-	2	-	-			
Total Credits :			**20**	**15**	**8**	**10**			

*** Mandatory subject: Question paper will be of objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade/Class/Rank.**

Re-registration of I semester subjects: Div A to L

Basaveshwar Engineering College, Bagalkot
Department of Mechanical Engineering
Academic Year 2020 – 2021 Even Semester

2nd Semester (175 Credits Regular) – PHYSICS GROUP

Sl. No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
1	UMA261C	Engineering mathematics-II	4	3	2	-	50	50	100
2	UPH262C	Engineering Physics	4	3	2	-	50	50	100
3	UME263C	Elements of Mechanical Engineering	3	2	2	-	50	50	100
4	UEE264C	Basic Electrical Engineering	3	2	2	-	50	50	100
5	UCS265C	Programming with C	3	3	-	-	50	50	100
6	UHS226M	Constitution of India*	-	2	-	-	50	50	100
7	UPH266L	Engineering Physics Laboratory	1.5	-	-	3	50	50	100
8	UCS267L	C Programming Laboratory	1.5	-	-	3	50	50	100
		Total Credits :	**20**	**15**	**8**	**6**			

2nd Semester (175 Credits Regular) – CHEMISTRY GROUP

Sl. No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
1	UMA261C	Engineering Mathematics-II	4	3	2	-	50	50	100
2	UCH268C	Engineering Chemistry	4	3	2	-	50	50	100
3	UEC269C	Basic Electronics	3	2	2	-	50	50	100
4	UCV270C	Engineering Mechanics	3	2	2	-	50	50	100
5	UBT233M	Environmental Studies*	-	2	-	-	50	50	100
6	UME271L	Computer Aided Engineering Graphics	2.5	1	-	3	50	50	100
7	UCH272L	Engineering Chemistry Laboratory	1.5	-	-	3	50	50	100
8	UBE273L	Basic Engineering Laboratory	2	-	-	4	50	50	100
9	UHS274K	English for Engineers	-	2					
		Total Credits :	**20**	**15**	**8**	**10**			

*** Mandatory subject: Question paper will be of objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade/Class/Rank.**

Re-registration of I semester subjects: Div A to L

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

Sl. No	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
01	UMA 333 C	Computation Methods for Mechanical Science	3	3	-	-	50	50	100
02	UME 311 C	Material Science & Metallurgy	3	3	-	-	50	50	100
03	UME 3xx C	Basic Thermodynamics	3	2	2	-	50	50	100
04	UME 3xx C	Strength of Materials	3	2	2	-	50	50	100
05	UME 312 C	Foundry and Welding Tech	3	3	-	-	50	50	100
06	UME 307 L	Material Science & Material Testing Lab	1	-	-	2	50	50	100
07	UME 310 L	Mechanical Drawing Lab	1	-	-	2	50	50	100
08	UME 308 L	Foundry & Forging Lab	1	-	-	2	50	50	100
10	UME 3XX O	***Online Course-I**	1	-	-	-	-	-	-
11	UMA 330 M	****Bridge Course Mathematics - I	0	3	-	-	50	50	100
12	UBT 133 M	Environmental Studies	-	2	-	-	50	50	100
13		Adalita Kannada (AK)	-	2	-	-	50	50	100
14		Vyavaharika Kannada (VK)	-	2	-	-	50	50	100
		Total Credits :	**20**	**22**	**04**	**06**	**600**	**600**	**1200**

*Online course options

1. 3 online course of 1 Credit each
2. 1 online course of 2 credits + one online course of 1 credits
3. One online course of 3 credits,
4. The course should be of minimum 04 weeks duration to earn 01 credit
5. Online course should be a subject other than the enlisted above.

** Bridge Course Mathematics – I 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.

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	UMA 433C	Statistical Methods for Mechanical Science	3	3	-	-	50	50	100
02	UME 416C	Metrology & Instrumentation	3	3	-	-	50	50	100
03	UME 417C	Machining and Machine Tools	3	3	-	-	50	50	100
04	UME 415C	Applied Thermodynamics	3	2	2	-	50	50	100
05	UME 419C	Theory of Machines	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	2	-	-	4	50	50	100
09	UME 411L	CAMD Lab	2	1	-	2	50	50	100
10	UME 4XXO	*Online Course-II	1	-	-	-	-	-	-
11	UMA 430M	**Bridge Course Mathematics-II	0	3	-	-	50	50	100
		Total Credits :	**22**	**17**	**06**	**08**	**500**	**500**	**1000**

****Online course options**

1. 3 online course of 1 Credit each
2. 1 online course of 2 credits + one online course of 1 credits
3. One online course of 3 credits,
4. The course should be of minimum 04 weeks duration to earn 01 credit
5. Online course should be a subject other than the enlisted above.

** 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.

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 4th and 6th semester to earn 02 credits which will be awarded during 7th Semester.

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

Sl. No	Code	Subject	Credits	Hours/Week		Examination Marks			
				Lecturer	Tutorial	Practical	CIE	SEE	Total
01	UME 509C	Design of Machine Element	3	2	2	-	50	50	100
02	UME 512C	Metal Forming	3	2	2	-	50	50	100
03	UME 513C	Fluid Mechanics	3	2	2	-	50	50	100
04	UHS 002N	Advanced Quantitative Aptitude and Soft Skills	1	-	2	-	50	50	100
05	UME 5XXN	*Open Elective – I	3	3	-	-	50	50	100
06	UME 505H	Management and Entrepreneurship	3	3	-	-	50	50	100
07	UME 5XXE	Dept Elective – I	2	2	-	-	50	50	100
08	UME 5XXL	Fluid Mechanics & Machinery Lab	1	-	-	2	50	50	100
09	UME 5XXL	Fuels & I.C Engine Lab	1	-	-	2	50	50	100
10	UME 516P	Advance C programming Lab	2	-	-	4	50	50	100
11	**UME 510 O**	****On line course-III**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
		Total Credits	**23**	**14**	**08**	**08**	500	500	1000

Department Electives List
The Students have to select any one elective from the following table

Subject Code	Subject
UME XXX E	Quality and Reliability Engineering
UME XXX E	Automobile Engineering
UME 535 E	Non Traditional Machining

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

******Online course options

1. 3 online course of 1 Credit each
2. 1 online course of 2 credits + one online course of 1 credits
3. One online course of 3 credits,
4. The course should be of minimum 04 weeks duration to earn 01 credit
5. Online course should be a subject other than the enlisted above.

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) 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 XXX C	Project Management	3	3	-	-	50	50	100
04	UME XXX C	Engineering Economics	3	3	-	-	50	50	100
05	UHS 003 N	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 6XXL	HMT Lab	1	-	-	2	50	50	100
09	UME 6XXL	Dynamics Lab	1	-	-	2	50	50	100
10	UME 6XXL	Industrial Automation Lab	1	-	-	2	50	50	100
11	UME 611P	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

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

Sl No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
01	UME7XXC	Finite Elements Methods	3	2	2	-	50	50	100
02	UME 724C	Turbo Machines	3	2	2	-	50	50	100
03	UME 7XX E	Dept Elective – II	3	3	-	-	50	50	100
04	UME 7XX E	Dept Elective – III	3	3	-	-	50	50	100
05	UME 7XX E	Dept Elective – IV	3	3	-	-	50	50	100
06	UME7XX N	Open Elective – III	3	3	-	-	50	50	100
07	UME 705 L	CAE Lab	1	-	-	2	50	50	100
08	UME XXX L	CNC Lab	1	-	-	2	50	50	100
09	UME 711 P	Project Phase – I	3	-	-	6	50	50	100
10	UME XXX X	Internship	2	-	-	4			
		Total Credits	**25**	**16**	**04**	**14**	**450**	**450**	**900**

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

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 4th and 6th semester to earn 02 credits which will be awarded during 7th Semester.

Electives offered by the Department:
The Students have to select any three elective from the following table

Subject Code	Subject
UME 713 E	Non Disructive Testing
UME 721 E	Advance Manufacturing Technology
UME 712 E	Composite Materials
UME 727 E	Control Engineering
UME XXX E	Tool Design
UME 720 E	Power Plant Engineering
UME XXX E	Refrigeration & Air conditioning
UME XXX E	Operation Management
UME XXX E	Six Sigma

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

Sl. No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
01	UME 8XXE	Dept Elective - V	3	3	-	-	50	50	100
02	UME 8XXE	Dept Elective - VI	3	3	-	-	50	50	100
03	UME 8XXE	Dept Elective - VII	3	3	-	-	50	50	100
04	UME 809P	Project Phase-II	12	-	-	24	50	50	100
05	UME XXX X	Seminar	1	-	-	2	50	50	50
Total Credits			**22**	**09**	**-**	**26**	**300**	**300**	**600**

Electives offered by the Department

The Students have to select any three elective from the following table

Subject Code	Subject
UME 814 E	Advanced Metal Joining Processes
UME XXX E	Product Design & Rapid Prototyping
UME XXX E	Information Technology Approaches in Manufacturing
UME 828 E	Hydraulics And Pneumatics
UME 811 E	Theory of Elasticity
UME XXX E	Design of Mechanism
UME 821 E	Project Management
UME XXX E	Reliability Engineering and Experimental Design
UME XXX E	Supply Chain Management
UME XXX E	Renewable Energy
UME XXX E	Computational Fluid Dynamics