VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017

B.E. Automobile Engineering

III SEMESTER

Sl. No	Subject Code	Title	Teaching Dept.	Teaching Hours /Week			Examination				Credits
				Lecture	Tutorial	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15MAT31	Engineering Mathematics-III	Mathematics	04			03	20	80	100	4
2	15AU32	Material Science and Metallurgy	Automobile	04			03	20	80	100	4
3	15AU33	Engineering Thermodynamics	Automobile	03	02		03	20	80	100	4
4	15AU34	Mechanics of Materials	Automobile	03	02		03	20	80	100	4
5	15AU35	Mechanical Measurements and Metrology	Automobile	04			03	20	80	100	4
6	15AU36	Manufacturing Process-I	Automobile	04			03	20	80	100	3
7	15AUL37	Metallographyand Material Testing Laboratory	Automobile	01		02	03	20	80	100	2
8	15 AUL38	Foundry and Forging Laboratory	Automobile	01		02	03	20	80	100	2
TOTAL				**24**	**04**	**04**	**24**	**160**	**640**	**800**	**27**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
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SCHEME OF TEACHING AND EXAMINATION 2016-2017

B.E. Automobile Engineering

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Dept.	Teaching Hours /Week			Examination				Credits
				Lecture	Tutorial	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15MAT 41	Engineering Mathematics-IV	Mathematics	04			03	20	80	100	4
2	15AU42	Fluid Mechanics	Automobile	03	02		03	20	80	100	4
3	15AU43	Kinematics of Machines	Automobile	03	02		03	20	80	100	4
4	15AU44	Automotive Engines	Automobile	04			03	20	80	100	4
5	15AU45	Computer Aided Machine Drawing	Automobile	01		03	03	20	80	100	4
6	15AU46	Manufacturing Process -II	Automobile	03			03	20	80	100	3
7	15AUL47	Mechanical Measurement and Metrology Lab	Automobile	-		03	03	20	80	100	2
8	15AUL48	Machine Shop	Automobile	-		03	03	20	80	100	2
TOTAL				**18**	**04**	**09**	**24**	**160**	**640**	**800**	**27**

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ENGINEERING MATHEMATICS-IV

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: The objective is to provide students with mathematics fundamental, necessary to formulate, solve and analyze engineering problems by making them to learn the following topics

1. Numerical methods to solve ordinary differential equations
2. Finite difference method to solve partial differential equations
3. Complex analysis
4. Sampling theory
5. Joint probability distribution and stochastic process

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module-I		
Numerical Methods : Numerical solution of ordinary differential equations of first order and first degree, Picard's method, Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae). Numerical solution of simultaneous first order ordinary differential equations, Picard's method, Runge-Kutta method of fourth order.	10 Hours	L1, L4, L6
Module -2		
Numerical Methods :Numerical solution of second order ordinary differential equations, Picard's method, Runge-Kutta method and Milne's method **Special Functions:** Bessel's functions- basic properties, recurrence relations, orthogonality and generating functions. Legendre's functions - Legendre's polynomial, Rodrigue's formula, problems.	10 Hours	L1, L2, L6
Module -3		
Complex Variables: Function of a complex variable, limits, continuity, differentiability,.Analytic functions-Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem with proof and problems.**Transformations:** Conformal transformations, discussion	10 Hours	L1, L4, L6

of transformations: = , = , = + (/) and bilinear		
Module -4		
Probability Distributions: Random variables(discrete and continuous), probability functions. Poisson distributions , geometric distribution, uniform distribution, Exponential and normal distributions, Problems. **Joint probability distribution:** Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.	10 Hours	L1, L2, L3, L6
Module -5		
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **Stochastic process:** Stochastic process, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.	10 Hours	L1, L2, L3, L6

Course outcomes: On completion of this course, students are able to:

1. use appropriate numerical methods to solve first and second order ordinary differential equations.
2. use Bessel's and Legendre's function which often arises when a problem possesses axial and spherical symmetry, such as in quantum mechanics, electromagnetic theory, hydrodynamics and heat conduction.
3. State and prove Cauchy's theorem and its consequences including Cauchy's integral formula, compute residues and apply the residue theorem to evaluate integrals.
4. Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous statistical methods .

Graduate Attributes (as per NBA):

- Knowledge. of Mathematics
- Problem Analysis.
- Design / development of solutions (partly).

Question paper pattern:

The question paper will have ten questions.
Each full question consists of 16 marks.
There will be 2full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. B.V.Ramana "Higher Engineering M athematics" Tata McGraw-Hill, 2006
2. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.

Reference Books:

1. N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition.
2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley, 2013
3. H. K Dass and Er.RajnishVerma ,"Higher Engineerig Mathematics", S. Chand publishing, 1st edition, 2011.

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FLUID MECHANICS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – IV

Subject Code	15AU42	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Number of Tutorial Hours/Week	02		
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:
The objectives of this course are to make students:

1. To define fluid properties, describe Pascal's law, Hydrostatic law, and solve static fluid problems
2. To explain Buoyancy and Stability concepts of floating objects
3. To apply Bernoulli's principle to solve fluid flow problems
4. To make dimensional analysis of fluid mechanics problems
5. To explain the concepts of laminar flow, viscous flow through pipes and plates
6. To analyze various forces acting on submerged bodies

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module-I		
PROPERTIES OF FLUIDS Introduction, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapor pressure and cavitation. **Fluid Statics** : Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.	10 Hours	L1, L2, L3, L6
Module -2		
BUOYANCY Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically. **Fluid Kinematics**: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only), velocity and acceleration, velocity potential function and stream function.	10 Hours	L1, L2, L3, L4

Module -3		
FLUID DYNAMICS Introduction, equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation. **Fluid Flow Measurements:**Venturimeter, orificemeter, pitot-tube, vertical orifice, V-Notch and rectangular notches.	10 Hours	L1, L2, L4
Module -4		
DIMENSIONAL ANALYSIS Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham π theorem, dimensionless numbers, similitude, types of similtudes. **Flow through pipes:** Minor losses through pipes. Darey's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL.	10 Hours	L1, L2, L4, L6
Module -5		
LAMINAR FLOW AND VISCOUS EFFECTS: Reyonold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseille's equation, laminar flow between parallel and stationary plates. **Flow past immersed bodies** : Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness. **Introduction to compressible flow** : Velocity of sound in a fluid, Mach number, Mach cone, propagation of pressure waves in a compressible fluid.	10 Hours	L1, L2, L4

Course outcomes:

On completion of this course, students are able to:

1. Define fluid properties and distinguish between types of fluids.
2. Describe Pascal's law, Hydrostatic law & their application to solve engineering static fluid problems.
3. Explain the concepts of Buoyancy and stability of floating objects.
4. Explain the kinematics of fluid like types of flows, application of continuity equations.
5. Explain the forces acting when fluid is under motion & application of Bernoulli's equation for solving flow problems.
6. Explain the different methods of measurement of flows.
7. Analyze dimensional analysis methods and its applications to engineering problems.
8. Explain and estimate the various types of losses occurring when fluid is flowing through the pipes.
9. Explain the concepts of laminar flow & viscous flow through the pipe and plates.
10. Analyze various forces acting on submerged bodies in engineering flow problems.

Graduate Attributes (as per NBA):

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly).

Question paper pattern:

The question paper will have ten questions.
Each full question consists of 16 marks.
There will be 2full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Fluid Mechanics by Pijush.K.Kundu, Ira M. Cohen, ELSEVIER, 3rd Ed. 2005.
2. Fluid Mechancis by Dr. Bansal, R.K., Lakshmi Publications, 2004.

Reference Books:

1. Fluid Mechanics and hydraulics, Dr.Jagadishlal, Metropolitan Book Co-Ltd., 1997.
2. Fluid Mechanics (SI Units), Yunus A. Cengel John M.Cimbala, TataMaGrawHill, 2006.
3. Fluid Mechanics by John F.Douglas, Janul and M.Gasiorek and john A.Swaffield, Pearson
4. Education Asia, 5th ed., 2006
5. Fluid Mechanics and Fluid Power Engineering, Kumar.D.S, Kataria and Sons., 2004

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
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KINEMATICS OF MACHINES
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – IV

Subject Code	15AU43	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Number of Tutorial Hours/Week	02		
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

The objectives of this course are to make students:

1. To define the basic terms such as kinematic chain, kinematic pair, degree of freedom etc. associated with kinematics of machinery
2. To determine the mobility of given mechanisms
3. To sketch and explain inversions of four bar mechanism, single slider crank mechanism and double slider crank mechanism
4. To determine the velocity and acceleration of links using graphical or analytical methods
5. To plot the profile of a cam using displacement diagram
6. To define gear terminology and determine the velocity ratio in different gear trains

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module-I		
INTRODUCTION, KINEMATIC CHAINS,INVERSIONS & MECHANISMS Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine. Inversions of Four bar chain; Single slider crank chain and Double slider crank chain. 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 wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.	10 Hours	L1, L2, L3, L6
Module -2		
VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS Velocity and acceleration analysis of Four Bar mechanism,	10 Hours	

slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles .in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration.Angular velocity and angular acceleration of links, velocity of rubbing.Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method		L1, L2, L3, L4, L6
Module -3		
VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS, KLEIN'S CONSTRUCTION: Analysis of velocity and acceleration of single slider crank mechanism.Analysis of four bar chain and slider crank chain using analytical expressions. (Use of complex algebra and vector algebra) Analysis of velocity and acceleration of single slider crank mechanism by Klens's construction.	10 Hours	L1, L2, L3, L4, L6
Module -4		
GEARS & GEAR TRAINS Gear terminology, Law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio of Spur, Helical, Bevel and Worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification. Types of Gear trains, velocity ratio, Train value, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.	10Hours	L1, L2, L3, L4, L6
Module -5		
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-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.	10 Hours	L1, L2, L3, L4, L6

Course outcomes:

On completion of this course, students are able to:

1. Define and explain the terms such as Link, Kinematic chain, Kinematic pair, types of pairs, degree freedom, Mechanism, Machine Mobility.
2. Sketch and explain various types of mechanisms, and their inversions.
3. Draw Velocity and Acceleration of simple mechanisms using Instantaneous centre method, Analytical and Graphical methods.
4. Explain the Gear terminology, Law of gearing, gear tooth systems
5. Determine the velocity ratio of different types of gear trains using tabular and algebraic methods
6. To draw cam profile and calculate the velocity and acceleration of cams at any given instant.

Graduate Attributes (as per NBA):

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly).

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Question paper pattern:

The question paper will have ten questions.
Each full question consists of 16 marks.
There will be 2full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. **Theory of Machines",** Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines",** Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006

Reference Books:

1. **"Theory of Machines & Mechanisms**", J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambekar, PHI

Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself.

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AUTOMOTIVE ENGINE [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV			
Subject Code	15AU44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			

Course objectives:

The objectives of this course are to make students:

1. To differentiate between the constructions details of spark ignition and compression ignition engines and to classify engines.
2. To explain the construction and working principle of fuel systems
3. To gain the knowledge of combustion process in SI and CI engines
4. To have the thorough knowledge of supercharging and turbo charging and apply the same to IC engines
5. To gain knowledge of cooling and lubrication systems in automotive engines

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module-I		
CONSTRUCTION AND OPERATION Engine classification, Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines – construction and working. Comparison of SI and CI engines and four stroke and two stroke engines, theoretical and actual valve timing diagrams for engines. Engine Cycles: theoretical Otto, diesel and dual cycles, Fuel-air Cycles and Actual cycle.	10 Hours	L1, L2
Module -2		
FUEL SYSTEMS Air fuel ratio requirements of SI engines, Working of a simple fixed venturi carburetor and limitations, gasoline injection system, types, Diesel fuel injection systems-inline pumps, distributor pumps, Types of Nozzles, Unit injector and common rail injection systems, Need and types of governor for diesel engines and their comparison.	10 Hours	L1, L2, L4
Module -3		
COMBUSTION IN S.I AND C.I. ENGINES Introduction to combustion in SI and CI engines and stages of combustion.Factors effecting ignition lag and flame propagation in S.I. Engines, factors effecting delay period and uncontrolled combustion in C.I. Engines. Importance of Swirl, squish and turbulence in C.I. Engines	10 Hours	L1, L3, L4, L5
Module -4		
SUPERCHARGING, TURBOCHARGING and COOLING SYSTEMS Supercharging and Turbocharging, Different methods of turbocharging, Intercooling, Turbocharger controls including, waster gate, variable geometry, Need for cooling, types of cooling systems- air and liquid	10 Hours	L4, L5, L6

cooling systems. Thermo-syphon and forced circulation and pressurized cooling systems. Properties of coolants. Fuels: In		
Module -5		
FUELS AND LUBRICANTS Fuels for S.I and C. I engines and their requirements, Fuel ratings necessity of lubrication systems. Types-mist, pressure feed, dry and wet sump systems. Properties of lubricants.BIS standards for fuels and lubricants.	10 Hours	L1, L3, L4, L5

Course outcomes: On completion of this course, students are able to:

1. Explain the constructional details of SI and CI engines and classify engines
2. Explain the construction and working of carburetors and fuel injection pumps
3. Explain the combustion process in SI and CI engines
4. Suggest an efficient cooling system for IC engines
5. Suggest a proper lubricant to be used in an automobile used in various environmental conditions

Graduate Attributes (as per NBA):

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly).

Question paper pattern:

The question paper will have ten questions.
Each full question consists of 16 marks.
There will be 2full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. V. Ganesan "Internal Combustion Engines" 2007, Tata McGraw Hill
2. Ramalingam K.K., "Internal Combustion Engines", Sci-Tech Publications, 2005.

Reference Books:

1. Heisler "Advanced Engine Technology" SAE Publication
2. Edward F. Obert "Internal Combustion Engines"
3. H.N. Gupta Fundamentals of Internal Combustion Engines, PHI
4. Mathur and Sharma "Internal Combustion Engines " DhanpatRai and Sons 2002
5. John B. Heywood, "Fundamentals of Internal Combustion Engines",

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COMPUTER AIDED MACHINE DRAWING [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV			
Subject Code	15AU45	IA Marks	20
Number of Lecture Hours/Week	**T-01, P-03**	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			

Course objectives:

The objectives of this course are to make students:

1. To acquaint with the tools of drafting and modeling software
2. To draw the solutions to sections of solids, draw orthographic views of simple machine parts using software
3. To sketch and explain various thread forms and their application
4. To calculate parameters related to riveted joints and sketch them
5. To prepare assembly drawing from the list of components
6. To create solid models and draw the sectional views of automotive systems

PART A (2D Only)

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module-I		
INTRODUCTION: Review of graphic interface of the software. Basic sketching commands and navigational commands.Starting a new drawing sheet. Sheet sizes. Naming a drawing.Drawing units, grid and snap. **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 for the drawings) Hidden line conventions.Precedence of lines.	08 Hours	L1, L2, L3, L5
Module -2		
THREAD FORMS Thread terminology, forms of threads – BSW Thread, Sellers thread, ISO Metric thread, square and Acme thread. Conventional representation of threads. **Fasteners**: Hexagonal headed bolt and nut with washer (assembly), square-headed bolt and nut with washer (assembly). Types of Bolt heads, special types of nuts, locking of nuts, Studs,	08 Hours	L1, L5

set screws, grub screws.		
PART B (2D Only)		
Module -3		
KEYS, COTTER AND KNUCKLE JOINTS Types of Keys, Cotter and knuckle Joints**Riveted Joints:** lap joints- single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snaphead rivets).	08 Hours	L1, L2, L5
Module -4		
AUTOMOTIVE COMPONENTS Spark plug, IC Engine valve, Rocker arm, Cylinder liner, Stub-axle, Oldham's coupling and universal coupling (Hooks' Joint) **Couplings:** Split Muff coupling, Protected type flanged coupling, pin	08 Hours	L1, L2, L5
PART C- ASSEMBLY DRAWINGS (Part drawings should be given)		
Assembly drawing of following machine parts (3D parts to be created and assembled and then getting 2D drawing with required views, along with 3D part drawings). 1. Plummer block (Pedestal Bearing) 2. Petrol Engine piston 3. I.C. Engine connecting rod 4. Screw Jack 5. Single cylinder crank shaft 6. Machine vice	18 Hours	L1, L3, L4, L5

Course outcomes:

1. Use the Solid Edge software for drawing and solid modeling.
2. Sketch the solutions of the sections of solids, determine the inclination of the cutting plane when true shape of section of an object is given.
3. Sketch and draw the orthographic views of simple machine parts (top view, front view, side view) using first angle projection.
4. Sketch and draw the sectional views of simple machine parts.
5. Sketch and draw ISO metric threads, Square, ACME & BSW forms of threads using conventional representation.
6. Distinguish between temporary and permanent joints and sketch and draw the different types of keys.
7. Sketch and draw two views of different types of riveted joints
8. Sketch and draw two views of different automotive components, couplings and joints
9. Create solid models of different parts and assemble them and draw their sectional views using Solid Edge software.
10. Prepare assembly drawings along with their bill of material.

Graduate Attributes (as per NBA):

- Engineering Knowledge.

- Problem Analysis.
- Design / development of solutions (partly).

Text Books:

1. 'Machine Drawing' , K.R. Gopala Krishna, Subhash Publication.
2. 'A Primer on Computer Aided Machine Drawing', Published by VTU, Belgaum.
3. 'Machine Drawing', N.D.Bhat&V.M.Panchal
4. 'Automobile Engineering Drawing', R.B.Gupta, SatyaPrakashan, New Delhi

Reference Books:

1. 'A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007
2. 'Machine Drawing with Auto CAD'. GoutamPurohit&GouthamGhosh, 1st Indian print Pearson Education, 2005
3. 'Machine Drawing' , N. Siddeshwar, P. Kanniah, V.V.S. Sastri, Tata Mc GrawHill,2006

Internal assessment: 20 Marks
All the sheets should be drawn in the class using software. Sheet sizes should be A3/A4. All sheets must be submitted at the end of the class by taking printouts.

Scheme of Examination: Two questions to be set from each Part.
Student has to answer one question from each Part.

PART-A: 1x15	=	15 Marks
PART-B: 1x15	=	15 Marks
PART-C: 1x50	=	50 Marks
Total	**=**	**80 Marks**

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MANUFACTURING PROCESS -II [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV			
Subject Code	15AU46	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			

Course objectives:

The objectives of this course are:

1. To explain the nomenclature of single point cutting tool, mechanics of chip formation, tool failure criteria and to solve problems on evaluation of tool life
2. To explain the construction and working of various systems in a Lathe, Shaper, Planing and Drilling machine
3. To classify grinding and milling machines and explain their construction
4. Explain the principles of broaching

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module-I		
THEORY OF METAL CUTTING& **CUTTING TOOL MATERIAL**S Single point cutting tool nomenclature, geometry, Mechanics of Chip Formation, Types of Chips. Merchants circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems on Merchant's circle diagram analysis. Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life.Tool Failure Criteria, Taylor's Tool Life equation, Problems on tool life evaluation. Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids - Desired properties, types and selection.Heat generation in metal cutting, factors affecting heat generation.Heat distribution in tool and workpiece and chip.Measurement of tool tip temperature.	08 Hours	L1, L2, L3
Module -2		
TURNING , SHAPING and PLANING Classification of Lathe, constructional features of Turret and Capstan Lathe. Tool Layout, Different operations on lathe, machining. . Classification of Shaping Machine, PlaningMachine, shaping and planing machines, construction and working principle of planning and shaping machine.Machining time calculation on above machining operations.	08 Hours	L1, L2, L3
Module -3		

MILLING &GRINDING MACHINES Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts.Various milling operations. **Indexing**: Simple, compound, differential and angular indexing calculations. Simple problems on simple compound indexing. **Grinding Machines:** Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centreless,cylindrical and surface grinding). Selection of grinding wheel.Grinding process parameters. Dressing and truing of grinding wheels.	08 Hours	L1, L2, L3
Module -4		
DRILLING, BROACHING PROCESS AND FINISHING OPERATIONS **Drilling Machine:**Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, materials. **Broaching Machine:**Principle of broaching.Details of a broach.Types of broaching machines-constructional details.Applications.Advantages and Limitations. **Finishing and other Processes:** Lapping and Honing operations – Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application	08 Hours	L1, L2, L3
Module -5		
NON-TRADITIONAL MACHINING PROCESSES Need for nontraditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.	08 Hours	L1, L2, L3

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

1. Define various terminologies used in production technology.
2. Explain basic concepts used in construction of various machine tools.
3. Analyze the various mechanisms underlying the working of various machine tools.
4. Select the appropriate machining process depending on the properties of the raw material required to produce the desired product.
5. Realize the significance of non-traditional machining.
6. Realize the significance of technological advances in the field of automating manufacturing engineering activities.

Graduate Attributes (as per NBA):

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly).

Question paper pattern:

The question paper will have ten questions.
Each full question consists of 16 marks.

There will be 2full questions (with a maximum of four sub questions) from each module.
Each full question will have sub questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Workshop Technology, HazaraChoudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. Production Technology, R.K.Jain, Khanna Publications, 2003.
3. Production Technology, HMT, Tata MacGraw Hill, 2001.

Reference Books:

1. Manufacturing Science, AmitabhaGhosh and Mallik, affiliated East West Press, 2003.
2. Fundamentals of Metal Machining and Machine Tools, G. Boothroyd, McGraw Hill, 2000.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV			
Subject Code	15AUL 47	IA Marks	20
Number of Practical Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	39	Exam Hours	03
CREDITS – 02			

Course objectives:

The objectives of this course are to make students:

1. To identify the measuring instrument and demonstrate its usage
2. To calibrate pressure sensor, thermocouple, LVDT and load cell
3. To explain the usage of slip gauges for calibration of vernier caliper, height gauge and micrometer
4. To determine the form tolerance (cylindricity and circularity)
5. To determine thread and gear parameters using standard tests
6. To take care of measuring instruments

	Laboratory Experiments:	**Revised Bloom's Taxonomy (RBT) Level**
PART-A: MEASUREMENTS		
1	Calibration of Pressure Gauge (Bourdon tube pressure gauge)	L1, L2, L3, L5
2	Calibration of Thermocouple	L1, L2, L3, L5
3	Calibration of LVDT	L1, L2, L3, L5
4	Calibration of Load cell	L1, L2, L3, L5
5	Determination of modulus of elasticity of a mild steel specimen using Strain gauges.	L1, L2, L3, L5
6	Speed measurement-using Stroboscope	L1, L2, L3, L5
PART-B: METROLOGY		
1	Calibration of Micrometer, Vernier caliper, Height gauge using slip gauges	L1, L2, L3, L5
2	Measurements using Optical Projector / Toolmaker Microscope.	L1, L2, L3, L5
3	Measurement of Angle using Sine Center / Sine bar / bevel protractor	L1, L2, L3, L5
4	Measurement of Cylindricity and Circularity of Automobile Components	L1, L2, L3, L5
5	Measurement of Straightness and Flatness	L1, L2, L3, L5
6	Calibration of Bore gauge, inside micrometer and component measurement	L1, L2, L3, L5
7	Measurement of Screw threads parameters using Two wire or Three-wire method	L1, L2, L3, L5

8	Measurements of Surface roughness using Tally Surf/Mechanical Comparator	L1, L2, L3, L5
9	Measurement of gear tooth profile using Gear Tooth Vernier/Gear Tooth Micrometer	L1, L2, L3, L5
10	Measurement using Optical Flats	L1, L2, L3, L5

Note: Students are required to know thoroughly about the;

1. Working and usage of measuring instruments such as Vernier Caliper, Micrometer, Dial gauge and slip gauges.
2. The datum and reference surfaces such as Surface plate, V-Block, Angle plates etc.

Course outcomes:

At the end of this laboratory, students will be able to:

1. Identify the measuring instruments, explain their parts and demonstrate its usage
2. Calibrate pressure sensor, thermocouple, LVDT, load cell.
3. Demonstrate the determination of modulus of elasticity of MS specimen experimentally using strain gauges.
4. Demonstrate the usage of slip gauges for the calibration of micrometer, vernier caliper, height gauge.
5. Determine the unknown angle using sine bars, bevel protractor
6. Demonstrate the measurement of Cylindricity and circularity of given components.
7. Measure thread parameters using three wire/two wire methods and gear parameters using gear tooth vernier.
8. Demonstrate the usage of tally surf to measure the surface rough parameters of a machined component.

Scheme of Examination:

ONE question from Measurements (part -A)	35 Marks
ONE question from Metrology (part -B)	35Marks
Viva –Voce	10 Marks
Total	**80 Marks**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017

MACHINE SHOP

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	15AUL 48	IA Marks	20
Number of Practical Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	39	Exam Hours	03

CREDITS – 02

Course objectives:

The objectives of this course are to make students:

1. To apply the basic concepts/knowledge gained in the course "Manufacturing Process-II" for preparing 4 to 6 models using various machining operations on machine tools like milling, drilling, lathe, shaper and grinding
2. To have knowledge of basic setting of machines for an operation and machine tool maintenance

Laboratory Experiments:	**Revised Bloom's Taxonomy (RBT) Level**
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.	L1, L3, L5
PART-B	
Cutting of V- Groove/ Dovetail / Rectangular groove using a shaper. Cutting of Gear Teeth using Milling Machine.	L1, L3, L5

Course outcomes:

At the end of this laboratory, students will be able to:

1. Apply the basic concepts/knowledge of machine tools gained through the course "Manufacturing Process-II" to prepare the models listed below.
2. Demonstrate the knowledge and the skills required with respect to the operation of machine tools, carry out various machining operations.
3. Prepare the models using the above machines, study their importance and applications.

Scheme of Examination:

One Model from Part – A	40 marks
One Model from Part – B	30 marks
Viva – Voce	10 marks
Total:	**80 marks**