POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI
Choice Based Credit System (CBCS)
Scheme of Teaching and Examination 2019 – 20
(Effective from the academic year 2019 – 20)

III Semester

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week			Examination				
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	Credits
1	BS	19MA31	Computational Methods for Mechanical Sciences (Mathematics – III)	Mathematics	2	2	--	03	50	50	100	3
2	PC	19AU32	Material Science and Metallurgy	Automobile Engg	3	--	--	03	50	50	100	3
3	PC	19AU33	Theory of Machines	Automobile Engg	3	2	--	03	50	50	100	4
4	PC	19AU34	Basic Thermodynamics	Automobile Engg	4	--	--	03	50	50	100	4
5	PC	19AU35	Manufacturing Process	Automobile Engg	3	--	--	03	50	50	100	3
6	NCMC	19CV36	CIV	Civil Engineering	2	--	--	02	50	50	100	0
7	HU	19KAK37/KAN37	Kannada Language	Humanities	01	--	--	01	50	50	100	1
8	PC	19AUL31	Material Science and Material Testing Lab	Automobile Engg	--	-	2	03	50	50	100	1
9	PC	19AUL32	Foundry and Forging Lab	Automobile Engg	--	--	2	03	50	50	100	1
10	PC	19AUL33	Computer Aided Machine DrawingLab	Automobile Engg	--	--	2	03	50	50	100	1
Total					18	04	06	27	500	500	1000	21
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
11	NCMC	19MAD031	Advance Mathematics - I	Mathematics	03	-		03	50	50	100	0

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IV Semester

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1.	PC	19AU41	Manufacturing Technology	Automobile Engg	3	--	--	03	50	50	100	3
2.	PC	19AU42	Fluid Mechanics	Automobile Engg	3	2	--	03	50	50	100	4
3.	PC	19AU43	Mechanical Measurements and Instrumentation	Automobile Engg	3	--	--	03	50	50	100	3
4.	PC	19AU44	Internal Combustion Engines	Automobile Engg	4	-	---	04	50	50	100	4
5.	PC	19AU45	Strength of Materials	Automobile Engg	3	2	--	03	50	50	100	4
6.	NCMC	19CV46	CIP	Humanities	2	--	-	02	50	50	100	0
7.	PC	19AUL41	Fluid Mechanics Lab	Automobile Engg	--	--	2	03	50	50	100	1
8.	PC	19AUL42	Internal Combustion Lab	Automobile Engg	--	--	2	03	50	50	100	1
9.	PC	19AUL43	Machine Shop Lab	Automobile Engg	--	--	2	03	50	50	100	1
Total					18	04	06	27	450	450	900	21
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
10	NCMC	19MAD041	Advance Mathematics - I	Mathematics	03	--	--	03	50	50	100	0

Detailed syllabus of III & IV semester courses offered for 2019-20 entry students

Course Title: Material Science and Metallurgy		
Subject Code	19AU32	CIE: 50
Number of Lecture Hours/Week	03 (Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Modules		Teaching Hours
Module – I Concept Of Material Science: Fundamental concepts of unit cell, space lattice, Study of crystal structure for cubic structures & HCP, Coordination Number and Atomic Packing Factor for different cubic structures. Crystal imperfections-classification, types. Diffusion: diffusion mechanism, Fick's laws of diffusion. Concepts of stress & strain, tensile properties, Rockwell, Vickers & Brinell hardness testing.		09 hours
Module – II FAILURE OF MATERIALS: Fracture: types, stages in cup & cone fracture, Griffith's criterion. Fatigue: fatigue tests, S-N curves, Factors affecting fatigue life and protection methods, Creep: creep curves, Mechanisms of creep, creep - resistant materials.		08 hours
Module - III Solid Solutions: Types of solid solutions, Rules of governing the formation of Solid Solution, Phase diagrams: Basic terms, phase rule, cooling curves, construction of phase diagrams, Interpretation of equilibriums diagrams, Types of phase diagrams. Lever rule. (Numerical Problems) Iron - Carbon Equilibrium Diagram: Phases in the Fe–C system, Invariant reactions, critical temperatures, Microstructure of slowly cooled steels, effect of alloying elements on the Fe-C		09 hours

diagram, Ferrite & Austenite stabilizers. The TTT diagram, Drawing of TTT diagram forhypo-& hypereutectoid steel, Effect of alloying elements, CCT diagram.	
Module - IV Heat Treatment: Annealing, and its types, normalizing, hardening, tempering, Martempering, Austempering, surface hardening like case hardening, carburizing, cyaniding, nitriding Induction hardening, hardenabilty, Jominy end-quench test,	08 hours
Module - V Study Of Engineering Alloys: Ferrous Alloys*:* Properties, composition and uses of low carbon, Mild, medium & high carbon steels. Steel designation & AISI designation. Microstructure of Cast irons, grey CI, white CI, malleable CI, and SG iron. Non-Ferrous Alloys*:* Properties, composition and uses of the light alloys, Al & Mg & Titanium alloys. Copper & its alloys: brasses & bronzes.	08 hours

Question paper pattern:

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 4 sub divisions

Text books:

1."Materials Science & Engineering- An Introduction", William D.Callister Jr. Wiley India Pvt. Ltd. 6th Edition, 2006, N. D
2."Essentials of Materials For Science And Engineering", Donald R. Askeland, Pradeep P.Phule, Thomson-Engineering, 2006.

Reference Books:

1. "Introduction to Material Science for Engineering", 6th edition James F. Shackel ford. Pearson, Prentice Hall, New Jersy, 06.
2. "Physical Metallurgy, Principles & Practices", V Raghavan. PHI 2nd Edition 2006, New Delhi.
3. "Foundation of Material Science and Engineering", Smith, 3rd Edition McGraw Hill, 1997

E books and online course materials:		
Course outcomes: On completion of the course, the student will have the ability to:		
Course Code	CO #	Course Outcome (CO)
19AU32	CO1	Explain the crystal structures , their properties & defects.
	CO2	Describe diffusion mechanisms and reasons for failure of materials .
	CO3	Discuss the concepts of solid solutions, phase diagrams & phase transformation.
	CO4	Select the various heat treatment process for Engineering applications
	CO5	Identify the composition and structure of ferrous and non-ferrous materials.

Course Title: THEORY OF MACHINES		
Subject Code	19AU33	CIE: 50
Number of Lecture Hours/Week	3 (Theory)+ 2 (Tutorial)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Modules	Teaching hours
Module- I Simple Mechanisms: Introduction, Kinematic link, Types, Structure Difference between a Machine and Structure, Kinematic pair, Types of constrained motions, Classification of Kinematic pairs, Kinematic chain, Mechanisms, Degrees of freedom in plane mechanisms, Inversions of Mechanisms. Mechanisms With Lower Pairs: Introduction, Pantograph, Exact straight line mechanisms Steering gear mechanisms,	8
Module- II Velocity Polygons: Introduction, Relative velocity of two bodies moving in straight Line, Velocity of a point on a Link by Relative Velocity Method, Velocity of a mechanism, Rubbing Velocity, Numericals. Acceleration Polygons: Introduction, Acceleration Diagrams of simple mechanism,	8
Module- III CAMS: Types of cams and followers, displacement velocity and acceleration curves for uniform Velocity, Uniform acceleration and retardation and SHM. Cam profile for reciprocating and oscillating followers. Maximum velocity and maximum acceleration during uniform velocity. Acceleration and retardation and SHM of follower. Numericals Balancing Of Masses: Static and dynamic balancing of rotating masses in single and different planes.(Basic Concepts), Numericals	8

Module -IV Turning Moment Diagrams And Flywheel: Introduction, Turning moment diagram for single cylinder double acting steam engine, Four stroke cycle IC Engine, Multi cylinder engine, Fluctuation of Energy, Determination of maximum fluctuation of energy, Co-efficient of fluctuation of energy, Flywheel, Numericals Governors : Introduction, Types of Governors, Centrifugal Governors, Terms used, Watt governor, Porter governor, Proell governor, Sensitiveness of Governors, Stability of Governors, Effort and power of Governors. Numericals	9
Module-V Toothed Gears: Introduction, Advantages and Disadvantages of Gear Drive, Classification of Toothed wheels, Terms used in Gears, Law of gearing, cyclodal Teeth, Involute Teeth, Length of path of contact, Length of arc of contact, contact Ratio. Numericals Gear Trains : Introduction, Types of Gear Trains, Simple, Compound, Reverted, Epicyclic Gear trains Velocity Ratio of Gear Trains, Numericals	9

Question paper pattern:

1. Total of ten questions with two questions from each module to be set covering entire syllabus.
2. Five full questions are to be answered selecting at least one full question from each module.
3. Each question should not have more than 4 sub divisions.

Text books: Theory of machines by Jagadishlal,

Theory of machines by R S Khurmi and Gupta

Theory of machines by S S Rattan

Reference Books:

1. J. S. Rao and R. V. Dukkipati, Mechanism and Machine Theory y New Age International, 1992.
2. T. Bevan. Theory of Machines CBS Publishers an Distributors, 1984.
3. J. E. Shighley and J. J. Uicker, Theory of Machines and Mechanisms McGrawHill, 1995.
4. L. Meirovitch, Elements of Vibration Analysis McGraw Hill1998.
5.W. T. Thomson and M. D. Dahleh Theory of Vibration with Applications

E books and online course materials: NPTEL Kinematics of machines-Richard Durley		
Course outcomes: On completion of the course, the student will have the ability to:		
Course Code	CO #	Course Outcome (CO)
19AU33	CO1	Explain basic concepts of mechanisms and applications.
	CO2	Determine velocities & accelerations of various planar Mechanisms.
	CO3	Draw profiles of cam for follower motion, calculate balancing mass in a plane.
	CO4	Draw turning moment diagrams, calculate fluctuation of energy and calculate forces in governors.
	CO5	Calculate velocity ratio of gear trains.

Course Title: Basic Thermodynamics		
Subject Code	19AU34	CIE: 50
Number of Lecture Hours/Week	04 (Theory)	SEE: 50
Total Number of Lecture Hours	52	SEE Hours: 03
Modules		Teaching Hours
Module – I Introduction To Thermodynamics: Fundamental concepts- introduction, concept of pressure, volume, specific volume, density, Engineering thermodynamics definition, some practical applications of engineering thermodynamics, macroscopic and microscopic point of view. Systems- closed, open and isolated. Homogeneous and heterogeneous systems. Thermodynamic equilibrium-mechanical, chemical, and thermal thermodynamic state, properties, processes, cycle, Path and point functions, intensive properties, extensive properties, quasi static process. Temperature And Zeroth Law Of Thermodynamics: concept of temperature, Zeroth law of thermodynamics, measurement of temperature, temperature scale, comparison of thermometers, gas thermometers, electrical resistance thermometer, thermocouple, international temperature scale.(Numericals)		10 hours
Module – Ii Work And Heat: Mechanics, definition of work and its limitations, Thermodynamic definition of work, examples, sign convention. Displacement work, as part of a system boundary, as whole of a system boundary. Expressions for displacement work in various processes through PV diagram. Shaft work, Electrical work, other types of work, heat definition; units and sign convention (Numericals) First Law Of Thermodynamics: Joule's experiment, equivalence of heat and work, statement of first law of thermodynamics. Extension of first law to non-cyclic processes, energy as property, modes of energy. Definition of pure substance, two property rule, Sp heat at constant volume, Enthalpy, Sp. heat at constant pressure. (Numericals)		10 hours
MODULE – III Extension Of First Law To Control Volume: Derivation of Steady state steady flow energy equation (SFEE), its important applications like Nozzle,		

diffuser, throttle valve, heat exchanger, turbine, compressor (Numericals) Second Law Of Thermodynamics: Devices converting heat to work (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal energy reservoir. Direct heat engine; Schematic representation & efficiency. Reversed heat engine, schematic representation, Co-efficient of performance. Kelvin Planck statement of second law of thermodynamics; PMM II Clausius statement of II law of thermodynamics; Equivalence of the two statements, reversible & irreversible processes; Carnot cycle, Carnot principles, Thermodynamic temperature scale. (Simple Numerical)	11 hours
MODULE – IV Entropy: Clausius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property. Principle of increase of entropy, Calculation of entropy using Tds relation. (Simple Numerical) Pure Substances: P-T & P-V diagrams, triple point & critical points. Sub-cooled liquid, Saturated liquid, mixture of saturated liquid & vapor, saturated vapor & superheated vapor states of a pure substance with water as example. Enthalpy of phase change. Dryness fraction, T-S & H-S diagrams representation of various processes on these diagrams, Steam tables & its use. Throttling calorimeter, Separating & throttling calorimeter. (Simple Numerical)	11 hours
Ideal Gases: Introduction, Ideal gas equation of state, internal energy & enthalpy as functions of temperature only. Universal and particular gas constants, Specific heats for perfect gases. Evaluation of heat, work, change in internal energy, Enthalpy and Entropy in various quasi static processes. (Numerical) Real Gases: Introduction; Vanderwaal's Equation, Vanderwaal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart, generalized compressibility chart. (Numerical)	10 hours
Question paper pattern: 1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus. 2. Five full questions are to be answered selecting at least One full question from each Module. 3. Each question should not have more than 4 sub divisions	
Text books: 1.Thermodynamics-An engineering approach, fifth edition by Yunus A Cengel and Michael A Boles, TMH publishers, 7, West Patel Nagar, New Delhi-110008 2.Basic and Applied Thermodynamics by P K Nag, TMH publishers, New Delhi-110008	

Reference Books:

1.Thermodynamics by S C Gupta, Pearson Education(P) Ltd, Indian branch, 482, FIE, Patparganj, Delhi-110092
2. Thermal Engineering by R K Rajput, Laxmi publications pvt Ltd, New Delhi

E books and online course materials:

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19AU34	CO1	Explain thermodynamic terminology and concept of temperature.
	CO2	Discuss the concept of heat and work and first law of Thermodynamics.
	CO3	SFEE analysis for flow devices with applying first law of thermodynamics and Heat engine and refrigerators analysis using Second Law of thermodynamics
	CO4	Illustrate entropy concepts and identify the properties of Pure Substances.
	CO5	Analyze the ideal and real gas effects on thermodynamic properties

Course Title: Manufacturing Process		
Subject Code	19AU35	CIE: 50
Number of Lecture Hours/Week	03 (Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Modules		Teaching Hours
Module – I Introduction: Manufacturing processes, Break Even Analysis, Engineering Materials and their properties. Metal Casting Processes: Patterns, Moulding materials, cores, gating and Risering,		08 hours
Module – II METAL CASTING PROCESSES: Cupola melting practice, charge calculations, ladles, casting cleaning and Casting defects. SPECIAL CASTING PROCESSES: Shell molding, precision investment casting, Permanent mould casting, Die casting, Centrifugal casting.		09 hours
Module – III Metal Forming Processes: Nature of plastic deformation, Hot working and Cold working, Rolling, Forging, Extrusion and Sheet metal operations. Special Forming Methods: Explosive forming, Electromagnetic forming Electro Hydraulic forming and powder metallurgy.		09 hours
MODULE – IV Gas Welding And Cutting: Oxyacetylene welding equipment, Oxyacetylene Welding technique, Oxy hydrogen welding, Gas cutting. Electric Arc Welding And Resistance Welding: Principle of Arc, Arc welding equipment, Electrodes, Manual metal arc welding, carbon arc welding.		08 hours
MODULE – V Electric Arc Welding And Resistance Welding: Inert gas shielded arc welding, tungsten inert gas arc welding, Gas metal arc Welding, Arc cutting, Resistance welding-spot, seam, projection and butt welding. Other Fusion Welding Process: Thermit welding, Electro slag welding, Electron Beam welding And Laser beam welding.		08 hours
Question paper pattern: 1. Total of Ten Questions with Two questions from each Module to be set covering the entire		

syllabus. 2. Five full questions are to be answered selecting at least One full question from each Module. 3. Each question should not have more than 4 sub divisions
Text books: 1) Rao P N ‘manufacturing technology ‘’ Tata Mc Graw hill publishing co. ltd., New Delhi
Reference Books: 1) Heine R W, Loper C R and Rosenthal P C, “ Principles of Metal Casting”, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2) Parmar R S “ Welding processes and Technology”, Khanna publishers, New Delhi 3) Roy linberg, “Manufacturing process and materials of manufacture”, Prentice Hall of India, New Delhi

E books and online course materials:		
Course outcomes: On completion of the course, the student will have the ability to:		
Course Code	CO #	Course Outcome (CO)
19AU35	CO1	classify the engineering materials and patterns.
	CO2	discuss the cupola furnace and casting process.
	CO3	explain metal forming of metal and powder metallurgy.
	CO4	demonstrate and explain gas welding and cutting, arc welding.
	CO5	compare resistance welding and other fusion welding.

Course Title: Material Science and Material Testing lab		
Subject Code	19AUL31	CIE: 50
Number of Practical Hours/Week	02 (Practical)	SEE: 50
Total Number of Lecture Hours	28	SEE Hours: 03

Modules	Teaching Hours
METALLURGY 1. (a) Specimen preparation for metallographic Inspection. (b) Study of metallurgical microscope. 2. (a) Study of microstructure of Grey C.I. and S.G.Iron in unetched condition (b) Study of microstructure of Grey C.I. and S.G.Iron in etched condition (c) Study of microstructure of White C.I. and Malleable Iron 3. Study of microstructure of plain carbon steels (a) Low carbon steel (b) Medium carbon steel (c) High carbon steel 4. (a) Study of microstructure of Aluminium alloys (b) Study of microstructure of Copper alloys MATERIALS TESTING 1. (a) Tension test on metals-stress strain characteristics, ductility, resilience and toughness (b) Hardness test on metals-Rockwell and Brinell tests 2. (a) Impact test on metals-Izod and charpy tests (b) Shear test on metals-Direct shear strength, single Shear and double shear 3. (a) Tests on wood-compression and bending-load, Deformation characteristics Youngs modulus, modulus of rupture. (b) Torsion test - load deformation characteristics Youngs modulus, modulus of rupture.	28 hours

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)

19UL31	CO1	To demonstrate the concepts of material science and microstructure
	CO2	To exhibit the skills of performing experimental tasks related to material testing
	CO3	To share the responsibility and contribute as a member of a team
	CO4	To analyze the data and interpret data to take valid decisions
	CO5	To prepare report about the experimental work

Course Title: Foundry and Forging-Lab		
Subject Code	19AUL32	CIE: 50
Number of Practical Hours/Week	2 (Practical)	SEE: 50
Total Number of Hours	28	SEE Hours: 03
Modules		Teaching Hours
TESTS OF MOULDING SAND AND CORE SAND: • Permeability test. • Clay content test • Moisture content test • Grain fineness test. Foundry practice • Pattern Making; pattern material, pattern allowances and types of patterns. • Uses of moulding tools: green sand moulding, gating system, risering system, core making. • Preparation of mould cavity using moulding box with single piece pattern and split pattern • Study of cupola. FORGING: Basic Forging processes like upsetting, drawing down and forge welding.(at least three models)		28 hours

Text books:

1. RAO P N, "Manufacturing technology",Tata McGraw Hill Publishing Co.Ltd.,New Delhi.

2. Materials and processes in Manufacturing by E.Paul Degarmo,8th ed.PHI,2002

3. Workshop Technology- by Hazra Choudary vol-1

Reference Books:

1. Heine R W,Loper C R and Rosenthal P C, “Principles of Metal Casting”, Tata McGraw Hill Publishing Co.Ltd.,New Delhi

2. Parmar R S ,”welding processes and technology”,Khanna publishers, New Delhi

3. Roy lindberg, “ Manufacturing Process and materials of manufacture”, Prentice Hall of India,New Delhi

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19AUL32	CO1	To demonstrate the understanding and application concept of foundry and forging work including various tests of moulding sand and core sand
	CO2	Practice foundry including pattern making , study cupola
	CO3	Practice basic forging processes including upsetting ,drawing down and forge welding
	CO4	
	CO5	

Course Title: Computer Aided M/C drawing -Lab		
Subject Code	19AUL33	CIE: 50
Number of Practical Hours/Week	02 (Practical)	SEE: 50
Total Number of Hours	28	SEE Hours: 03
Modules		Teaching Hours
Introduction And Conventions: Introduction to machine drawing, importance of sectional views, simple sectional views, Computer aided drafting Codes of practice for engineering drawing-BIS specifications-sectional views, Conventions for sectioning-Conventional representation of details-Drilled and tapped holes, countersunk and counter-bored holes, internal and external threads Conventions to represent standard components- Bolts, Nuts, Washers Screws, keys and cotters. Screw Threads and Fastners: ISO Metric thread(Internal & External),BSW thread, Square thread, Seller thread, Acme thread, Knuckle thread. Hexagonal headed bolt with nut and washer, Square headed bolt with nut and washer.(Using CAD package) Conversions Of Pictorial Views Into Orthographic Views: Conversion of pictorial views of simple Machine components into orthographic views. To mark sectional views also.(Using CAD package) Assembly Drawing Practice (Only 2D) Making free hand sketches of typical subassemblies-Cotter and Knuckle joints, Riveted joints, couplings-flange, flexible, universal,. (Using CAD package)		28 hours
Text books: .1Gopalkrishna k.R.,machine drawing,Subhash publications,Bangalore, 2006 2. N.D.Bhat and V M Panchal. machine drawing ,Chrotar publications,Anand.1996		

Reference Books:

1. BIS sp46-2003-"Engineering drawing practice for schools and colleges",new delhi-2003

2. k l Narayana,p Kanniah and Venkat reddy, New Age international publishers-New Delhi-2001

3.V T U - Machine Drawing

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19AUL33	CO1	To convert pictorial views into orthographic projections using CAD software.
	CO2	To sketch and draw two views of Nuts and Bolts using CAD software.
	CO3	To sketch and draw two views of Riveted joints using CAD software
	CO4	To sketch and draw two views of Cotter and knuckle joints using CAD software
	CO5	To sketch and draw two views of Couplings using CAD software

Course Title: Manufacturing Technology		
Subject Code	19AU41	CIE: 50
Number of Lecture Hours/Week	3 (Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Modules		Teaching Hours
Module-I Theory Of Metal Cutting: Mechanism of metal cutting - Cutting forces - Chip formation - Merchant's circle diagram - Calculations – Tool geometry - Machine ability- Tool wear - Tool life - Cutting tool materials - Cutting fluids. Turning Machines: Lathe: Specification - Types - Mechanisms - Operations - Calculations Capstan and turret lathe - Tooling with examples - Copy turning lathe.		10 Hours
Module-II Basic Machines: Shaper: Specification - Types - Mechanism - Calculations Planer: Specification - Types - Mechanism - Calculations. Drilling: Specification - Types - Operations – work and Tool holding devices, Drill tool nomenclature - Calculations. Other Basic Machines: Broaching: Specification - Types - Tool nomenclature - Broaching process. Boring: Specification - Types – Operations		9 Hours
Module-III Other Basic Machines: Boring tool - Jig Boring machine. Grinding of various machine elements - Lapping honing and super finishing. Grinding Machine: Grinding: Types of grinding machines, operations. - Designation and selection of grinding wheel - Bonds - Reconditioning of grinding wheel.		9 Hours
Module-IV Milling Machines: Milling: Specification - Types - Cutter nomenclature - Types of cutter Milling operations Milling processes. Indexing In Milling Machine: Indexing- Methods of Indexing. Compound and Differential Indexing. Simple Problems.		8 Hours
MODULE-V		

Non Traditional Machining Process: Principle, equipment, operation and application of Electric Discharge machining, Ultrasonic machining, Laser beam machining, Abrasive jet machining, Electron beam machining.	6 Hours

Question paper pattern:

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 4 sub divisions

Text books:

1. S.K. Hajra Choudry, S.K. Bose, "Workshop Technology Vol II"
2. P.C. Sharma, " A Text Books of Production Engineering " , S.Chand and Co.Ltd., IV Edition, 1993.
3. Production Technology by R.K.Jain, Khanna Publications,2003.
4. Production Technology by HMT, Tata MavGraw Hill, 2001

Reference Books:

1. De Garmo et al., "materials and Processes in Manufacturing , "Prentice Hall of India, Eight Edition, 1998
2. Richara R. Kibbe, John E. Neely, Roland O. Meyer and Warrant T. White, "Machine Tool Practices" , VI Edition, Prentice Hall of India, 1999
3. N.K. Mehia, "Machine Tool Design and NC", Tata McGraw Hill Publishing Co. Ltd., 1999.
4. Manufacturing Science by Amitabha Ghosh and Mallik, Affiliated East West press, 2003.

E books and online course materials:

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19AU41	CO1	Determine cutting force, tool geometry, wear and life
	CO2	Explain working principle of lathe
	CO3	Classify different basic machines used in the production
	CO4	Explain milling machine and perform indexing using milling machines
	CO5	Describe non-traditional machining process

Course Title: Fluid Mechanics		
Subject Code	19AU42	CIE: 50
Number of Lecture Hours/Week	3 (Theory) + 2 (Tutorials)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Modules		Teaching Hours
Module- I Properties Of Fluids: Introduction, properties of fluids, viscosity, thermodynamic properties, surface tension and capillarity, vapor pressure and cavitation. (Numericals) Pressure And Its Measurement: Fluid pressure at a point, absolute, gauge, atmospheric and vacuum pressures, Simple manometers, differential manometers. (Numericals)		8 Hours
Module -II Hydrostatic Forces On Surfaces: Total pressure and center of pressure, vertical plane surface submerged in liquid, horizontal plane surface submerged in liquid, inclined plane surface submerged in liquid, curved surface submerged in liquid. (Numericals) Buoyancy And Floatation: Buoyancy, center of buoyancy, metacenter and metacentric height, conditions of equilibrium of floating and submerged bodies.(Numericals)		8 Hours
Module -III Fluid Kinematics: Types of fluid flow, continuity equation, continuity equation in three dimensions (Cartesian co-ordinate system only), velocity and acceleration, velocity potential functions and stream functions. (Numericals) Dimensional Analysis: Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Buckingham's pi theorem, Raleigh's method, dimensionless numbers, similitude, types of similitude. (Numericals)		8 Hours
Module- IV Fluid Dynamics: Introduction, equations of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, Bernoulli's equation for		

real fluids. Flow measurements venturimeter, orifice meter, pitot tube. (Numericals) Flow Through Pipes: Major and minor losses, 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 line friction in pipes, hydraulic gradient and total energy lines. (Numericals)	8 Hours
MODULE -V Laminar Flow And Viscous Effects: Reynolds's number, critical Reynolds's number, Laminar flow through circular pipe-Hagen Poiseulle's equation, Laminar flow between parallel stationery plates.(Numericals) Flow Past Immersed Bodies: Drag, Lift, expression for lift and drag, pressure drag and friction drag, boundary layer concept, displacement thickness, momentum thickness and energy thickness. Introduction to fluid machines.	10 Hours

Question paper pattern:

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 4 sub divisions

Text books: 1. Fluid Mechanics by Oijush K.Kundu, IRAM COCHEN, EL SEVIER 3rd Ed. 2005.

2. Fluid Mechanics by Dr. Bansal.R.K, Lakshmi Publications, 2004.

3. Fluid Mechanics and hydraulics, Dr. Jagadishlal: Metropolitan Book Co-Ltd., 1997.

4. Fluid Mechanics (SI Units), Yunus A. Cingel John M. Oimbala. Tata MaGrawHill,2006.

Reference Books:

1. Streeter V.L. and Wylie E.B., " Fluid Mechanics ", McGraw Hill, 1983.

2. Ramamirtham S., " Fluid Mechanics, Hydraulics and Fluid Machines",Dhanpat Rai & Sons,

3. Fluid Mechanics R.K.Hegde, Niranjana Murthy Spana Book House,

4. Kumar.D.S: Fluid Mechanics and Fluid Power Engineering," Kataria and Sons.,2004.

5. Fluid Mechanics R.K.Hegde, Niranjana Murthy Spana Book House,

E books and online course materials:		
Course outcomes: On completion of the course, the student will have the ability to:		
Course Code	CO #	Course Outcome (CO)
19AU42	CO1	Interpret the properties of fluids and pressure measurements
	CO2	Evaluate the hydrostatic forces buoyant forces and stability
	CO3	Demonstrate the fundamentals of Fluid kinematics
	CO4	Formulate and solve equations of Control volumes of fluid dynamics.
	CO5	Determine the drag and lift forces. Evaluate resistance to flow through closed conduits for incompressible fluids

Course Title: Mechanical Measurements and Instrumentation		
Course Code	19AU43	CIE: 50
Number of Lecture Hours/Week	3(Theory)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Course Objectives:		
Modules		Teaching Hours
Module- I Standards Of Measurements: Definition and Objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, (M- 81, M-112), Numerical problems on building of slip gauges.		08 hours
Module- II System Of Limits, Fits, Tolerances And Gauging: Definition of tolerance, Specification in assembly, inter changeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, types of fits and their designation (IS 919 - 1963), hole basis system, shaft basis of system, Classification of gauges, brief concept of design of gauges, wear allowance on gauges, types of gauges -plain plug gauge, Ring Gauge, snap gauge, limit gauge and gauge materials. (Numerical)		09 hours
Module- III Comparators And Angular Measurement: Introduction to Comparator, Characteristics, classification of comparators, mechanical comparators Johnson Mikrokator, Sigma Comparators, dial indicator, Optical Comparators -principles, Zeiss ultra optimeter Electric and Electronic Comparators -principles, LVDT, Pneumatic Comparators, back pressure		09 hours

gauges, Solex Comparators. Angular Measurements, Bevel Protractor, Sine Principle and. use of Sine bars, Sine center, use of angle gauges, (numerical) Clinometers.	
Module- IV Measurements And Measurement Systems: Definition, Significance generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors In Measurements: Classification of Errors, sources of errors. Transducers: Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, electronic transducers, advantages of each type transducers	08 hours
Module -V Measurement Of Force: Principle, analytical balance, platform balance, proving ring, Measurement Of Torque: Concept of Torque, Prony brake, hydraulic dynamometer, hydrostatic dynamometer, Eddy current dynamometer. Measurement Of Pressure: Introduction, Principle types of pressure measuring devices, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani Gauge. Measurement Of Temperature: Introduction, Resistance thermometers, thermocouple, laws of thermocouple, materials used for construction, pyrometer, Optical Pyrometer	08 hours
Question paper pattern: 1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus. 2. Five full questions are to be answered selecting at least One full question from each Module. 3. Each question should not have more than 4 sub divisions	
Text books: 1. “Mechanical measurements & Instrumentation” , A.C.Niranjan, Pooja Pubblication	

2. “Mechanical measurements & Metrology”, T. Chandrashekhar, Subhash Publication

3. Test Book of Metrology, M Mahajan, Dhanpat Rai Publication , Delhi

Reference Books:

1. Acourse in Mechanical Measurements & Instrumentation, A.K. Sawhney, Dhanapat Rai & Co.

2. “Engineering Metrology”, R.K. Jain, Khanna Publishers. New Delhi

3. “Mechanical Measurements”, Beckwith, Buck & Marangoni, Narosa Publishing House.

E books and online course materials:

Course outcomes: On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19AU43	CO1	Explain and apply the basics of standards of measurement.
	CO2	Apply the knowledge of limits, fits & tolerances to design the gauges.
	CO3	Identify the uses of gauges like comparator and angle measuring instruments
	CO4	Discuss the significance of measurement system, errors, transducers, intermediate modifying and terminating devices
	CO5	Interpret measurement of field variables like force, torque and pressure Comprehend the fundamentals of thermocouple and strain measurement

Course Title: I.C.Engines		
Subject Code	19AU44	CIE: 50
Number of Lecture Hours/Week	4 (Theory)	SEE: 50
Total Number of Lecture Hours	52	SEE Hours: 03
Modules		Teaching Hours
Module-I Introduction To Ic Engines: Air Standard Cycles: Introduction, Otto cycle, diesel cycle, dual cycle or limited pressure cycle. Comparison of Otto, diesel and dual combustion cycles for same compression ratio and heat input, constant maximum pressure and same heat input, same maximum pressure and temperature. Fuel Air Cycles And Actual Cycles : Fuel air cycles, uses of fuel air cycles loss due to variation of specific heat, dissociation or chemical equilibrium loss, comparison of pressure volume diagram of air standard cycle and fuel air cycle. Actual cycles, difference between real cycles and fuel air cycles, time losses, dissociation losses, losses due to incomplete combustion, direct heat losses, exhaust blow down losses and pumping losses.		11 hours
Module-II Petrol And Diesel Fuels: Structure of petroleum, refining process, properties of petrol fuel, octane rating, properties of diesel fuel cetane rating, additives. Engine Performance: Performance parameters BHP, FHP, IHP, Specific fuel consumption, volumetric efficiency, Thermal efficiency, Specific weight, heat balance sheet, testing of engines.		10 hours
Module-III Combustion In Si Engines: Flame propagation, combustion limits of A/F mixture, Rate of pressure rise, normal combustion in SI engine-Abnormal combustion during normal combustion (Detonation) – Abnormal combustion in SI Engines, HUCR – methods of control of abnormal combustion. Development of combustion chambers in SI Engines, requirements of SI Engine combustion chambers, types of combustion chamber.		10 hours
Module-IV Combustion In Ci Engines: Air swirl in combustion chamber normal combustion in CI engine – delay period – factors affecting delay period –		

diesel knock and method of controlling diesel knock combustion chamber requirements for diesel engine. Types of combustion chamber – turbulent, non- turbulent combustion chamber.	11 hours
Module-V Advances In I C Engine: CRDI, HCCI Engines Dual and Multifuel 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.	10 hours

Question paper pattern:

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 3 sub divisions

Text books

1. A course in IC Engines – By Mathur and Sharma, Dhanpat Rai.
2. IC Engines – Jhon B Heywood, McGraw Hill Book, 1998
3. IC Engines- V.Ganesan, Tata McGraw Hill Book Co, 2002

Reference Books:

4. Modern Petrol Engine – By A.W.Judge, B.I. Pub.
5. I C Engines – By Litchy, MacGrawHill
6. High Speed Diesel Engines – By P.M.Heldt, Oxford and IBH.
7. I. C. Engines – By H.B. Keshwani, Standard Pub
8. I. C. Engines and air pollution- Obert, E.F, International text book publishers, 1983

E books and online course materials:

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19AU44	CO1	Analyze air standard, fuel air and actual cycles and compare them.
	CO2	Interpret the properties and rating of The fuel, evaluate engine performance parameters.
	CO3	Express the combustion phenomena in S.I. Engines and design aspects.
	CO4	Express the combustion phenomena in C.I. Engines and design aspects
	CO5	Illustrate modifications and combustion phenomena in advanced engines

Course Title: Strength of Materials

Subject Code	19AU45	CIE: 50
Number of Lecture Hours/Week	03 (Theory) + 02 (Tutorials)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Modules		Teaching Hours
Module – I Simple Stress And Strain: Stress, strain, mechanical properties of materials, Hooke's law and Poisson's ratio. shear stress, shear strain, stress-strain relation- behaviour in tension for mild steel and non ferrous metals, bars with cross section varying in steps, bars with continuously varying cross section (circular and rectangular), Volumetric strain, expression for volumetric strain, elastic constants, stresses in composite section and temperature stresses (including compound bars.)		09 hours
Module – II Bending Moment And Shear Force In Beams: Types of beams, types of loads, shear forces and bending, bending moments, relationship between shear force and bending moments. Shear force and bending moment diagrams for statically determinate beams subjected to point loads, uniform distributed loads.		08 hours
Module - III Stress In Beams: Theory of simple bending, assumptions in simple bending equation section modulus and bending stresses in beams of various cross sections. Shear stresses in beams of rectangular, circular section. Deflection Of Beams: Differential equation for deflection, slope and deflection double integration method for cantilever and simply supported beams for point load and UDL. Macaulay's method.		09 hours
Module – IV Torsion Of Shafts: Torsion equation for circular shafts, strength & stiffness of solid & hallow circular shafts (uniform cross- section), Transmission of power. Compound Stresses: Pure shear, plane stress, stresses on inclined sections, principal stresses, Mohr's circle for plane stress.		08 hours
Module – V Thin And Thick Cylinders: Stresses in thin cylinders, changes in dimensions of cylinder. Lame's equation, thick cylinder subjected to internal and external pressure (compound cylinders not included) Columns: Short and long column, elastic stability of column, Euler's formula with different end conditions, limitations of Euler's theory, Rankine's formula.		08 hours

Question paper pattern:

1. Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2. Five full questions are to be answered selecting at least One full question from each Module.
3. Each question should not have more than 4 sub divisions

Text books:

1. "Strength of materials" S.S.Bhavikatti, vikas publication house pvt.ltd., 2nd ed., 2006
2. "Mechanics of materials" K.V.RAO and G.C.RAJU, Subhash book house Banglore, 2nd ed.,
3. Elements of strength of materials, Ramamurtham.s ,Dhanpat Rai publications.

Reference Books:

1. "Strength of materials" Basavarajaiyya and Mahadevappa cbs publishersand distributors Delhi.
2. "Strength of materials" Ryder Bombay
3. "Mechanics of solids" S.B.Junarkar, McGraw Hill charter Delhi
4. "Mechanics of materials" S I.units Ferdinand Beer and Russel johnstan,Tata McGraw Hill – 2003

E books and online course materials:

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19AU45	CO1	Explain various types of loading and stresses induced.
	CO2	Calculate SFD and BMD for different types of loads and support conditions.
	CO3	Analysis of beams for stresses and deflection.
	CO4	Analysis of shear stress in the inclined plane and calculate the torque in the shaft.
	CO5	Analyze buckling phenomenon in columns and stresses in cylinder.

Course Title: Fluid Mechanics -Lab		
Subject Code	19AUL41	CIE: 50
Number of Hours/Week	2 (Practical)	SEE: 50
Total Number of Hours	28	SEE Hours: 03
Modules		Teaching Hours
1. Verification of Bernoulli's theorem. 2. Impact of jet on plate and cup 3.Reynolds experiment on laminar, transition and turbulent flow in pipe 4. Determination of friction factor in pipes 5. Determination of minor losses in pipes viz bend, sudden expansion, sudden contraction, entry and exit losses 6. Determination of co-efficient of discharge of venturimeter, orificemeter for incompressible fluid(water) flow. 7. Performance test on Impulse and Reaction turbines. 8. Performance test on Centrifugal Pump. 9. Determination of co-efficient of discharge of V-notch and Rectangular notch.		28 hours
Text books:		
Reference Books:		
E books and online course materials:		

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19AUL41	CO1	Evaluate coefficient of discharge of venturimeter and orificemeter.
	CO2	Evaluate performance of centrifugal pump.

	CO3	Determine the coefficient of discharge of notches.
	CO4	Demonstrate the head loss due to friction in a pipe.
	CO5	Evaluate head loss due to sudden enlargement and sudden contraction.

Course Title: I.C.Engine -Lab		
Subject Code	19AUL42	CIE: 50
Number of Hours/Week	2 (Practical)	SEE: 50
Total Number of Hours	28	SEE Hours: 03
Modules		Teaching Hours
Performance Test on I.C.Engines, Calculation of IP, BP, Thermal efficiency, SFC, FP, heat balance sheet and emission testing. 1.Four stroke diesel Engine 2.Four stroke petrol engine 3.Multi-cylinder Diesel/Petrol Engine, (Morse test) 4.Two stroke petrol Engine 5.Variable Compression Ratio I.C.Engine. 6.Performance test on computerized IC Engine test rig. 7.Study of valve timing diagram. 8.Study of fuel injection system. 9.Performance test using alternative fuels.		28 hours
Text books:		
Reference Books:		
E books and online course materials:		
Course outcomes: On completion of the course, the student will have the ability to:		
Course Code	CO #	Course Outcome (CO)

19AU42	CO1	Demonstrate valve time diagram and draw it for two stroke and four stroke engines.
	CO2	Evaluate performance of single cylinder and multi cylinder diesel engines and draw heat balance sheet.
	CO3	Evaluate performance of single cylinder Petrol engine.
	CO4	Determine the frictional horse power by Conducting Morse test.
	CO5	Evaluate performance of engine using computerized engine test rig.

Course Title: Machine shop -Lab		
Subject Code	19AUL43	CIE: 50
Number of Hours/Week	2 (Practical)	SEE: 50
Total Number of Hours	28	SEE Hours: 03
Modules		Teaching Hours
1.Operate various machines like lathe, shaper etc, 2. Perform plain turning, taper turning, screw cutting etc on lathe machine, 3. Perform machining operation on shaper 4.Demonstrate metal joining process like compressive welding 1. Plain turning, taper turning, step turning, thread cutting, facing, knurling, eccentric turning using lathe. 2. Cutting of gear teeth using milling machine. 3. Practice on shaping and drilling machine. 4. Demonstration of surface grinding. 5. Study of non-traditional machining processes.		28 hours

Text books:

1. S.K. Hajra Choudry, S.K.Bose, " Workshop Technology Vol II ".

2. P.C.Sharma, " A Text Books of Production Engineering ", S.Chand and Co. Ltd., IV Edition, 1993.

3. Production Technology by R.K.Jain, Khanna Publications, 2003.

4. Production technology by HMT, Tata MacGraw Hill, 2001.

Reference Books:

1. De Garmo et al., " Materials and Processes in Manufacturing ", Prentice Hall of India, Eight Edition, 1998.

2. Richara R. Kibbe, John E.Neely, Roland O. Meyer and Warrent T. White, " Machine Tool Practices ", VI Edition, Prentice Hall of India, 1999.

3. N.K.Mehia, " Machine Tool Design and NC ", Tata McGraw Hill Publishing Co. Ltd., 1999.

4. Manufacturing Science by Amitabha Ghosh and Mallik, affiliated East West Press, 2003.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19AUL43	CO1	To demonstrate the understanding and application concept of machining process.
	CO2	To perform machining operation using Lathes, Milling and Shaper machine
	CO3	To select Appropriate machining process to produce a component using different machines
	CO4	
	CO5	