STRUCTURE & SYLLABUS OF III TO IV SEMESTER

B.E. (INDUSTRIAL AND PRODUCTION ENGINEERING)

POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Choice Based Credit System (CBCS)

Scheme of Teaching and Examination 2019 – 20

(Effective from the academic year 2019 – 20 for 2019-20 admitted students)

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
1.	BS	19MA31B	Mathematics	Mathematics	2	2	--	03	50	50
2.	PC	19IP32	Material science and Metallurgy	I & PE	3	-	--	03	50	50
3.	PC	19IP33	Theory of Machines	I & PE	3	2	--	03	50	50
4.	PC	19IP34	Fluid Mechanics and Machines	I & PE	3	-	--	03	50	50
5.	PC	19IP35	Manufacturing Processes	I & PE	3		--	03	50	50
6.	HU	19Kan37	Kannada	HU	1			01	50	50
7.	PC	19IPL31	Material Testing lab	I & PE	--	-	2	03	50	50
8.	PC	19IPL32	Manufacturing Process lab	I & PE	--	--	2	03	50	50
9.	PC	19IPL33	Computer aided machine drawing	I & PE	1		2	03	50	50
10.	NCMC	19CV36	Environmental studies (CIV)	Civil	2	--	-	02	50	50
Total					**19**	**04**	**06**	**27**	**500**	**500**
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs										
10	19MAD31		NCMC	Advance Mathematics - I	Maths	03	--		03	50	50

Course title: COMPUTATIONAL METHODS FOR MECHANICAL SCIENCE

Course code:	19MA31B	Credits:	03
Teaching hours/week:	**2L+1T**	Total teaching hours:	28
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	

Prerequisite: **Students should have knowledge of Differential calculus, Integral calculus and Differential equations**

Course Objectives:

To enable the students to obtain the knowledge of Engineering Mathematics in the following topics

1. **Numerical methods to solve algebraic and Transcendental equations**
2. **Interpolation methods and Numerical integration**
3. **Fourier Series and Fourier transformation and its application in engineering fields**

Partial Differential equations and its applications.

Modules	**Teaching hours**
Module-I **Errors And Approximations** Errors in arithmetic operations, Errors in function, approximation by Taylor's series. Solutions of Algebraic and Transcendental Equations, Bisection method, Newton's Raphson Regula falsi methods and Secant method	**6 hours**
Module-II **Finite differences**: Differential operators: Forward, Backward, central & shift operators, Factorial polynomial & their relationship, with illustrative examples, Interpolation, Newton's Forward and Backward formulae. Lagrange's interpolation and inverse interpolation	**6 hours**
Module-III **Numerical differentiation** using Newton's forward and backward interpolation formulae and problems with illustrative examples of engineering applications. **Numerical integration**: Trapezoidal rule, Simpsons $1/3^{rd}$ and $3/8^{th}$ rule, Weddle's rule (all formulae and rules without proof) with engineering examples	**5 hours**
Module -IV	**5 hours**

Fourier series: Periodic functions, Fourier series with periods $(0, 2\pi)$, $(-\pi, \pi)$, $(0, 2l)$ and $(-l, l)$. Half range Fourier series, complex form of Fourier series.	
Module-V **Applications of PDE:** Derivation of one dimensional wave and heat equations. Various possible solutions of wave equation, heat equation Laplace equation by the method of separation of variables with given conditions and problems with illustrative examples for engineering application. .	**6 hours**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text book:

1 Higher Engineering Mathematics by B.S.Grewal, Khanna publishers; 40th Edition.2007

2 Engineering Mathematics by N. P. Bali and Manish Goyal. Laxmi publications, latest edition

Reference books:

1.Advanced Engineering Mathematics by E. Kreyszig, John Willey & sons 8th Edn.

2.A short course in differential equations – Rainvile E.D.9th Edition.

3.Advanced Engineering Mathematics by R.K.Jain & S.R.K Iyengar; Narosa publishing House.

4.Introductory methods of numerical analysis by S.S.Sastry

Course outcomes:

On completion of the course, the student will have the ability to:		
Course Code	**CO #**	**Course Outcome (CO)**
19IP32	**CO1**	Solve the numerical problems in algebraic, transcendental equations
	CO2	Computation of interpolation polynomials
	CO3	Computation of Numerical differentiation and numerical integration by using interpolation
	CO4	Construction of Fourier series for periodic signals and Fourier series to analyse circuits
	CO5	Determine Numerical solutions of wave, heat and Laplace equations.

Course title: Material Science And Metallurgy			
Course code:	19IP32	Credits:	03
Teaching hours/week:	3	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: Engineering mathematics, Physics& Chemistry			

Course Objectives:

- To enhance the knowledge of students in the engineering materials, structures, properties & design.
- To make expertise to the students in micro study of materials & Metallurgy.

- To make student skilled in the field of metal & their alloys by imparting the knowledge of compositions, properties & application of engineering alloys.
- To enhance the knowledge of students in different treatments given to the materials to improve the quality of engineering materials.
- Provide the information to students about defects in the materials and their causes.

To provide the practical knowledge to the students regarding strength of material, testing of materials and microstructures of the material

Modules	Teaching hours
Module I **Crystal Structure:** 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, Flick's laws of diffusion. Concepts of stress & strain, tensile properties, Rockwell, Vickers &Brunel hardness testing.	**9**
Module II **Fracture:** types of fractures: Ductile fracture, Brittle fractures, Shear fractures, stages in cup & cone fracture, **Fatigue:** fatigue tests, S-N curves, Factors affecting fatigue life and protection methods, **Creep:** creep curves, Mechanisms of creep, creep - resistant materials.	**8**
Module III **Solid Solutions:** Definition of Solid solution (SS), Types of solid solutions, Rules of governing the formation of SS, **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 diagram, Ferrite & Austenite stabilizers. The TTT diagram, Drawing of TTT, TTT diagram for hypo-& hypereutectoid steel, Effect of alloying elements, CCT diagram	**9**
Module IV Annealing, and its types, normalizing, hardening, tempering, Mar tempering, us tempering, surface hardening like case hardening, carburizing, cyaniding, nitriding Induction hardening, hardenabilty, Jominy end-quench test	**8**

Module V **Study of Engineering Alloys** **Ferrous Alloys:** Properties, composition and uses of low carbon, Mild, medium & high carbon steels. Steel designation &AISI designation. Cast irons, gray CI, white CI, malleable CI, and SC iron. Microstructures of cast iron. **Non-Ferrous alloys*:*** Properties, composition and uses of the light alloys, Al & Mg & Titanium alloys. Copper & its alloys: brasses & bronzes.	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:
"Materials Science & Engineering- An Introduction", William D.Callister Jr. Wiley India Pvt. Ltd. 6th Edition, 2006, N. D
"Essentials of Materials for Science and Engineering", Donald R. Askeland, Pradeep P.Phule, Thomson-Engineering, 2006.

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

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

Course Code	CO #	Course Outcome (CO)
	CO1	**Analyze** the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, APF (Atomic Packing Factor), Co-ordination Number imperfection in crystal, diffusion of material, etc.
	CO2	**Understand** concept of mechanical behaviour of materials, testing techniques and calculations of same using appropriate equations

19IP32	**CO3**	**Explain** concepts of phase & phase diagram & understand the basic terminologies associated with metallurgy. **Construction** and **identification** of phase diagrams and their reactions, Analyze the Iron Carbon system
	CO4	**Understand** and classify various heat treatment process & types including significance of properties versus microstructure
	CO5	**Explain and classify** compositions, micro structure, properties & applications of ferrous & non ferrous materials.

Course title: THEORY OF MACHINES			
Course code:	19IP33	Credits:	04
Teaching hours/week:	03+2Tutorials	Total teaching hours:	52
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: - Engineering Mechanics			

Course Objectives:

- To impart students with the knowledge about motion, masses and forces in machines.
- To enable students to apply fundamental of mechanics to machines which include Engines, linkages etc.,
- 3To facilitate students to understand the, the concept of balancing of Rotating and Reciprocating masses.

Modules	**Teaching hours**
Module I **Introduction :** Machine, Structure ,Types of motion ,Kinematics concept of links ,basic terminology and definition ,Mechanism, Inversion , Inversion of Quadratic chain, slider crank, double slider crank chain **Special Mechanisms**: Geneva Wheel, Universal Joint, Quick Return Motion mechanisms, St .line Mechanism.	**10**
Module II **Velocity Polygons**: Definition of instantaneous Centre, centode, Axode, Kennedy theorem for Instantaneous Centres, simple problems for finding the velocity of a point or velocity of link in mechanisms. **Velocity Polygons by Graphical solution:** Relative velocity, Velocity of a link, Velocity of a mechanism by Graphical methods. Simple problems for finding the velocity of a point or velocity of link in mechanisms. **Acceleration Polygons**: Acceleration of mechanism of simple mechanism, Klein Construction.	**11**

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.	**10**
Module IV **Flat belts and chain Drives:** Flat and V-belts drives, transmission of power by belts, Condition for maximum power transmission, efficiency power transmission. Simple problems.	**10**
Module V Theory of Gearing and Nomenclature, Types velocity ratio and torque calculation in cyclic gear trains Balancing of Masses: Static and dynamic balancing of rotating masses in single and different planes.(Basic Concepts)	**11**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books: Theory of machines by Jagadishlal

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

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

Course Code	CO #	Course Outcome (CO)
19IP36	**CO1**	List the Inversions of mechanism and special mechanisms
	CO2	Determine velocities & accelerations of various planar Mechanisms.
	CO3	Explain different types of cam profiles for follower motion.

	CO4	Calculate the width of belt for belt drives
	CO5	Describe Gear train and balancing, critical speeds with respect to machine dynamics

Course title: FLUID MECHANICS AND MACHINES			
Course code:	**19IP34**	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: Civil engineering & Mechanics			
Course Objectives:			

Modules	**Teaching hours**
Module I Properties of fluids, Hydrostatic pressure & its measurement. Manometers, Mechanical gauges. Pressure on plane and planed surfaces. Determination of centre of pressure. Buoyancy and Flotation-Equilibrium of floating bodies. Centre of buoyancy. Metacentre& determination of met centric height in simple cases. Condition of floating and submerged bodies. Stability of floating bodies.	**9**
Module II Kinematics of fluid flow: Method of describing fluid motion. Types of fluid flow, basic equation of fluid flow. Continuity equation and velocity & acceleration. Euler's equation, practical applications of Bernoulli's equation. Flow through orifices and mouthpieces. Measurement of flow orifice meter Venturimeter nozzle meter and bend meter.	**8**
Module III Flow through pipes-laminar flow& turbulent flow. Flow through pipes, friction factor, pressure losses in pipes and fittings. Dimension analysis and model testing. Secondary and derived equations. Dimensional homogeneity. Relights and Buckingham Pi theorem. Similitude testing and classification of models.	**9**
Module IV Pumps-positive displacement pumps, conventional details and power, efficiency calculations. Study of gear pumps, Vane pump & screw pump.	**8**

Module V Hydraulic machines-Accumulator, Intensifier, Ram, Hydraulic crane hydraulic press. Power transmission- Hydrostatic systems. Hydrodynamic systems. Pneumatic systems.	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Reference Books:

1. Fluid mechanics. - Streeter.
2. Fluid Mechanics and Hydraulic machines. - Bansal.
3. Applied Hydraulics. -Addison.
4. Theory of hydraulic machines. –Vasandani

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

Course Code	CO #	Course Outcome (CO)
19IP34	CO1	To understand fundamentals of fluid mechanics, including mass, energy and momentum balances etc.
	CO2	To set up and solve fluid mechanics problems both analytically and numerically, wherever appropriate.
	CO3	To relate fundamentals of fluid flow in fluid flow systems under different conditions.
	CO4	To examine related concepts on distribution systems.
	CO5	Understand and apply principles of hydraulic machines and systems.

Course title: MANUFACTURING PROCESS – I			
Course code:	**19IP35**	Credits:	03

Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: -			

Course Objectives:

- This course is designed to provide students with an overview of a wide variety of manufacturing processes
- The course is delineated particularly to understand the conventional manufacturing processes like casting, metal forging, and welding process
- 3. Be able to examine a product and determine how it was manufactured and why.

Modules	Teaching hours
Module I Introduction: Concept of Manufacturing process, its importance. A brief introduction to 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. Sand Moulding: Types of base sand, Properties of moulding sand, and moulding sand mixture ingredients	**8**
Module II Cores: Definition, Need, Types, Method of making cores, Binders used. Gating system & Risers: Principle involved and types. Moulding machines: Jolt type, squeeze type, and Sand singer. Special moulding Process, Study of important moulding processes. Casting: Gravity die-casting, Pressure die casting, centrifugal casting, Investment casting and continuous casting processes. Casting Defects : Causes, features and remedies	**9**
Module III Melting Furnaces: Classification of furnaces, Constructional features and working principle of Induction furnace, Electric Arc Furnace, and Cupola furnace. Fettling and cleaning of castings: Basic steps involved. Welding process: Definition, Principles, Classification, Application, Advantages &limitations of welding. Arc Welding: Principle, Inert Gas Welding (TIG & MIG), Submerged Arc Welding (SAW) and Atomic Hydrogen Welding processes. (AHW)	**8**
Module IV 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 Electron beam welding.	**8**

Module V Forging: Principle of forging, forging methods, and forging machines. Principles of soldering & brazing: Parameters involved & Mechanism. Different Types of Soldering &Brazing Methods. Inspection Methods :Methods used for Inspection of casting and welding. Visual, Magnetic particle, Ultrasonic, Radiography, , Holography methods of Inspection	**9**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:

1. "Manufacturing & Technology: Foundry Forming and Welding",P.N.Rao 2nd Ed., Tata McGraw Hill, 2003.

Reference Books:

1.Manufacturing Process-I", Dr.K.Radhakrishna, Sapna Book House,5th Ed, 2006.
2."Manufacturing Technology", SeropeKalpakjain, Steuen.R.Sechmid,Pearson Education Asia, 5th Ed. 2006.
3. "Process and Materials of Manufacturing:, Roy A Lindberg, 4th Ed.Pearson Edu. 2006

E books and online course materials: MP1 , pdf ppt online

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

Course Code	CO #	Course Outcome (CO)
19IP35	**CO1**	Students get ability of manufacturing Processes, Casting, Patterns, Moulding
	CO2	Students get ability to make cores, moulding machines, advanced casting process, remedies to casting defects
	CO3	Students get ability use melting furnaces, classification, welding, resistance welding
	CO4	Students get ability to do gas welding, torch construction, special type of welding
	CO5	Students get ability do forging, soldering, brazing, inspection methods

Course title: Material Science and Strength of Materials Lab			
Course code:	19IPL31	Credits:	01

Teaching hours/week:	**2hrs.(Practical)**	Total teaching hours:	28
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	

Prerequisite: Basic knowledge of compositions, properties and characteristics metals and alloys.

Course Objectives:

- To determine the mechanical properties of different material specimen.
- To give the basic knowledge about the methods to enhance the properties of the material from heat treatment process.
- To gain the basic knowledge about wear characteristics of ferrous, nonferrous and composite materials.
- To gain the practical knowledge about Non-destructive testing.
- To impart sound practical knowledge with respect to Metallographic practices and Material testing Procedures both Destructive and Non Destructive.

Modules	**Teaching hours**
Module-I 1. Preparation of specimen for Metallographic examination of different Engineering materials. Identification of microstructures of plain carbon Steels, tool steel, gray C.I, SG iron, Brass, Bronze & aluminium. 2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples. 3. To study the wear characteristics of ferrous, non-ferrous Materials for different parameters.	**14**
Module-II 1. Tensile, shear and compression tests of metallic and non metallic Specimens using a Universal Testing Machine. 2. Torsion tests. 3. Bending Tests. 4. Izod and Charpy tests on M.S. Specimen. 5. Brinell, Rockwell and Vickers's Hardness test.	**14**

Question paper pattern:

Scheme of Exam:

One Model from part 1	20 Marks
One Model from part 2	20 Marks
Viva Voce	10 Marks

Text books: 1. V. Raghavan

Reference Books:

1**.** William D Calister,

2. Material Science & Material Testing lab manual

E books and online course materials:

Study of basic crystal structure. Innovative practices.

Course outcomes:

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

Course Code	CO #	Course Outcome (CO)
19IP37	CO1	**Prepare** samples and investigate microstructures of different materials and test the materials for different parameters effectively.
	CO2	**Knowledge** of various properties of metals and metallic materials under different service loads and their responses at microstructure-level.
	CO3	**Apply** different heat treatment techniques to the materials to analyze the characteristics of metallic components, hence their suitability in specific applications.
	CO4	**Understand** the impact of the professional engineering solutions and practices with different tests like Tensile, Shear, Compression, Bending, Impact and hardness tests.
	CO5	**Recognize** and **demonstrate** for research to apply different application purpose.

Course title: Manufacturing Process-I Lab (Foundry & Forging)			
Course code:	19IPL32	Credits:	01
Teaching hours/week:	2	Total teaching hours:	28
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: -			

Course Objectives:

1. To able to prepare sand specimens to conduct tests
2. To use foundry tools and equipments
3. Preparing three forgings

Modules	Teaching hours
Module I Testing of Moulding sand and core sand Compression shear and tensile tests on UTM Permeability Test Core hardness &mould hardness test Sieve analysis test Clay content test Moisture content test	**12**
Module II Foundry Practice	**10**

Preparation of moulds using 2 mould boxes Using patterns and without patterns Demo of casting	
Module III Forging operations Upsetting Drawing Bending	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:
1. Foundry Manual

Reference Books:
1.Foundry and Forging Practice

E books and online course materials: PPT PDF you tube videos online

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

Course Code	CO #	Course Outcome (CO)
19IP32	CO1	Students get ability to demonstrate the understanding and application of concepts of Manufacturing Engineering
	CO2	Students get ability to exhibit the skills of performing manufacturing activities by experiments related to Foundry in order to generate the necessary product / output
	CO3	Students get ability to analyze shop floor conditions and take suitable decisions such as choosing manufacturing processes, tools and inspection methods
	CO4	Students get ability to show the skill of oral communication through explanations about various aspects of manufacturing processes
	CO5	Students get ability to prepare report about the experimental work on manufacturing activities

Course title: Computer Aided Machine Drawing-I			
Course code:	16IPL33	Credits:	02

Teaching hours/week:	1Hr Theory+2Hr Drawing	Total teaching hours:	14
Practical ours/week	02	Total practical hours	28
CIE: 50 marks	SEE: 50 marks	SEE: 3 hours	

Prerequisite: Computer aided engineering drawing (CADD)

Course Objectives: To develop skill to use software to create 2D drafting of machine components using any CAD (solid works, solid edge, Catia etc.) software

Course contents	**Practical Hours**
Method of dimensioning	2
Orthographic views of machine parts from pictorial views	4
Thread forms	4
Fasteners- square and hexagonal headed nut and bolt assembly	4
2-D drawing of (at least two) Knuckle join Socket and spigot cotter joint Protected type flange coupling	6
Assembly drawing (at least one) of above mentioned machine components	8

Note:

Internal assessment:

Students first prepare the sketches of the figures in drawing book and same is drawn using SOLID WORKS/SOLID EDGE software. All the sheets must be submitted after the completion of the lab work.

Question paper pattern: Students have to answer two questions. One question is set for 20 marks and another question is set for 30 marks

Text books:

1. Prof.N.D.Bhat & V.M.Panchal, Computer Aided Machine Drawing,Charotar Publishing House, Bengaluru

Reference Books:

1. Computer Aided Machine Drawing Lab Manual
2. K.R. Gopala Krishna, Computer Aided Machine Drawing, Subhas Stores, Bengaluru
3. S. Trymbaka, ‘A Text Book of Computer Aided Machine Drawing’,
Murthy, CBS Publishers, New Delhi, 2007
4. Goutam Pohit & Goutham Ghosh, ‘Machine Drawing with Auto CAD’, 1st Indian print Pearson Education, 2005
5. Sham Tickoo, ‘Auto CAD 2006, for engineers and designers'. Dream
tech 2005

E books and online course materials: YouTube, Scribd		
Course outcomes: On completion of the course, the student will have the ability to:		
Course Code	**CO #**	**Course Outcome (CO)**
19IPl33	**CO1**	Make two dimensional sketches and create orthographic views of given components in cad environment
	CO2	Sketch and prepare thread forms in cad environment software as per standards
	CO3	Create 2-d views of knuckle and cotter joints in cad environment and provide the dimensions of functional features
	CO4	Create 2d-sketches and cad models of the flange coupling using standard proportions
	CO5	Analyze and create sketch and assembly drawing of given machine components in cad environment with complete functional features.

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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 for 2019-20 admitted students)

IV 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	
1.	BS	19IP41	Quantitative Methods for Managerial decisions	I & PE/Maths Dept.	2	2	--	03	50	50	1
2.	PC	19IP42	Strength of Materials	I & PE	3	-	--	03	50	50	1
3.	PC	19IP43	Engg, Metrology & Measurement	I & PE	3	--	--	03	50	50	1
4.	PC	19IP44	Manufacturing technology	I & PE	3	-	--	03	50	50	1
5.	PC	19IP45	Manufacturing Automation Techniques	I & PE	3		--	03	50	50	1
6.	PC	19IP46	Thermodynamics & Heat Transfer	I & PE	3	-	-	03	50	50	1
7.	HU	19HU47	Constitution of India & Professional Ethics	HU	2	-	-	02	50	50	1
8.	PC	19IPL41	Metrology & measurement lab	I & PE	--	--	2	03	50	50	1
9.	PC	19IPL42	Machine shop	I & PE	--	--	2	03	50	50	1

10.	PC	19IPL43	Computer aided modeling lab	I & PE	-	--	2	03	50	50	1
11.											
Total					**19**	**2**	**06**	**29**	**500**	**500**	**1**
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs											
10	19XX	NCMC	Advance Mathematics - I	Mathematics	03	--		03	50	50	1

Course title: Strength of Materials			
Course code:	19IP42	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: Engineering mathematics, Physics and Engineering mechanics			
Course Objectives: Strength of materials is a core undergraduate engineering course that introduces the mechanics of deformable bodies. Students will study the basic concepts of solid mechanics and mechanical behaviour of materials, including stress-strain relationships, compound stresses, temperature stresses, compound bars, beam bending, torsion, stability of columns and stresses in thick and thin cylinders.			
Modules			**Teaching hours**
Module I **Simple stress and strain:** Stress, strain, mechanical properties of materials, Hooke' law. Shear stress, shear strain, Stress-strain relation-behaviour in tension for mild steel and nonferrous metals, Poisson's ratio.			**9**

Bars with cross section varying in steps, principle of superposition**.** Volumetric strain expression for volumetric strain, elastic constants.	
Module II **Composite bars:** stresses in composite section and temperature stresses (including compound bars) **Compound stresses:** Pure shear, plane stress, stresses on inclined sections, principal stresses, and Mohr's circle for plane stress.	**8**
Module III **Bending moment and shear force in beams:** Types of beams, types of loads, shear forces and bending moments, relationship between shear force and bending moment. Shear force and bending moment diagrams (SFD & BMD) for cantilever, simply supported and overhanging beams subjected to point loads (PL) & uniformly distributed (UDL) loads. **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	**9**
Module IV **Theory of simple bending:** assumptions, bending equation, section modulus and bending stresses in beams of various cross sections. **Theory of pure torsion:** assumptions, torsion equation, angle of twist, strength-rigidity criteria and shaft subjected to torsion only.	**8**
Module V **Columns:** short and long column, elastic stability of column, Euler's formula with different end conditions, limitations of Euler's theory, Rankine's formula. **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).	**8**
Question paper pattern: **CIE:** Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions. **SEE:** There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.	
Text books: 2. S.S.Bhavikatti, **Strength of Materials,** Vikas publication house Pvt.Ltd., 2nd Ed., 2006 3. K.V.Rao and G.C.Raju, **Mechanics of Materials**, Subhash book house banglore, 2nd Edition	
Reference Books:	

1. Basavarajaiyya and mahadevappa, **Strength of Materials,** CBS publishers and distributers Delhi
2. R.S. Khurmi and J.K.Gupta, **Strength of Materials**, Eurasia publishing house(Pvt.) Ltd. New Delhi
3. Ryder, **Strength of Materials**, BombayAsia
4. Ferdinand Beer and Russel Johnson, **Mechanics of Materials**, TATA McGrahill-2003
5. S.B.Junarker, **Mechanics of Solids**, McGraHill charter Delhi

E books and online course materials:
SOM video by IIT KGP Govt of India, skyciv software, video by Hochschule Karlsruhe University of Applied Science, E-book Applied mechanics and strength of materials by International library of technology

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

Course Code	CO #	Course Outcome (CO)
19IP42	CO1	Identify materials properties and solve engineering problems involving stress & strain in components subjected to various types of loads.
	CO2	Analyze principal stresses and develop graphical model (Mohr's circle) of stresses on inclined planes, subjected to combined loads.
	CO3	Solve problems involving shear force (SF) & bending moment (BM) of structural members and prepare the drawings of SF &BM
	CO4	Apply the pure bending and torsion theories to analyze stresses in members subjected to flexural and torsional loads
	CO5	Analyze the stresses in structural columns, cylinders and sketch the stress distributions in thick cylinders.-

Course title: Industrial Metrology and Measurements			
Course code:	19IP43	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	

Prerequisite: Physics, Basic Mathematics,	
Course Objectives: ● To enhance the knowledge of students in the products designed are within the process and measuring instruments capabilities available in the plant. ● To determine the process capabilities and ensure that these are better than the relevant parts tolerances. ● To determine the measuring instruments capabilities and ensure that these are adequate for their respective measurement. ● To minimize the cost of inspection by effective use of available facilities, and to reduce the cost of rejects and rework through application of Statistical Process Control techniques. ● Standardization of measuring methods. This is achieved by laying down the inspection methods for any product right at the time when the production technology is prepared. ● Maintenance of the measuring instruments used in the plant.	
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.	**8**
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)	**9**
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 gauges, Solex Comparators. **Angular Measurements**, Bevel Protractor, Sine Principle and. use of Sine bars, Sine centre, use of angle gauges, (numerical) Clinometers.	**9**
Module IV	**8**

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	
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.	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

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. A course 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.

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

Course Code	CO #	Course Outcome (CO)
	CO1	**Explain** and **apply** the basics of standards of measurement.

19IP43	**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	**Understand** 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: MANUFACTURING TECHNOLOGY			
Course code:	**16IP44**	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: Manufacturing process-I			
Course Objectives: To study the various types of machine tools and machining process, cutting forces in turning			

Modules	**Teaching hours**
Module I Theory of Metal cutting: Single point cutting tool nomenclature, geometry, Merchants circle diagram and analysis, Ernst merchant solution, shear angle relationship, problems of Merchant analysis, Tool wear tool life, effects of cutting parameters on tool life, Taylors tool life equation	**8**
Module II Cutting tool materials: Desired properties, types of cutting tool materials-HSS, carbides, coated carbides and ceramics. Cutting fluids: desired properties, and selection. Heat generation in metal cutting and heat distribution in tool. Lathe: Specifications, classification and constructional features of Engine, Turret and Capstan lathe, tool layout, operations on lathe, Process parameters and calculation of machining time	**9**
Module III Shaping and planning machines: Constructional features of shaping machine and planning machine, driving mechanism of shaping machine and planning machines, operation on shaping machine and planning machine parameters and calculation of machining time.	**8**

Drilling machines: Classification, constructional features, drilling and related operations, types of drill and drill bit nomenclature.	
Module IV Milling machines: Classification, constructional features, milling cutters types and their nomenclature, milling operations, up milling and down milling concepts. Process parameters, three forms of feed and machining time calculation Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.	**8**
Module V Grinding machines: Types of abrasives, bonding process, classification, constructional features (cylindrical and surface grinding), selection of grinding wheel. Lapping and Honing machines: Properties of operation, construction, applications. Non-traditional machining processes: Principle, equipment and operation of ultrasonic machining, electro chemical machining, abrasive jet machining and laser beam machining.	**9**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:

1. Workshop technology by Hazara Choudhary, vol-II, Media promoters & publishers pvt. Ltd. 2004.
2. Production technology by HMT, Tata MacGraw Hill, 2001
3. Manufacturing science by Amitabh Ghosh and Malik, affiliated Est West press, 2003.
4. Fundamentals of Metal Machining and Machine Tools by G. Boothroyd, McGRAW Hill, 2000.

5.Machine Tool Operations by A.C. Niranjan

Course outcomes:

1. Understand features and applications of automats, NC & CNC turning and machining centres.
2. Understand gear and thread production processes.
3. Understand and distinguish between the conventional and unconventional machining processes.

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

Course Code	CO #	Course Outcome (CO)
19IP44	CO1	Gain the knowledge of machine tools and analyze cutting forces.
	CO2	Study basics of tool materials and basics of simple turning machines
	CO3	Analyze the different machining processes.
	CO4	Understand gear and thread production processes
	CO5	Analyze between the conventional and unconventional machining

Course title: Manufacturing Automation Techniques			
Course code:	19IP45	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: Manufacturing process			

Course Objectives:

1This course introduces the fundamental concepts and elements of computer-aided design and manufacturing.

2. The course exposes students to various aspects of manufacturing, such as: computer integrated design and manufacturing systems, materials management, computer- aided process planning, alternative manufacturing organizations (Flexible, open cell concept, etc.) And various production processes

Modules	Teaching hours

Module I **Computers in manufacturing**;, Rule of computers in manufacturing, product cycle ,Computer aided design(CAD,), Computer aided manufacturing (CAM), Computer Integrated Manufacturing (CIM,)Advantages & Limitations ,Hardware ,Input and Out devices ,Types Peripherals ,Memories ,Types Storage devices. **Computer Graphics:** Raster scan graphics,coordinate systems, database structure for graphic modelling ,transformation of geometry ,clipping, hidden surface removal.	**9**
Module II **Geometric Modelling :** Requirements, Geometric models, construction methods, and constraint based modelling, other modelling methods, curve &surface representation, modelling facilities desired. **CAD Standards:** Standardization in graphics GKS, other graphic standards, exchange of modelling data	**8**
Module III **Computer Aided Process Planning :** The planning function ,retrieval type process planning systems generative process planning systems, benefits of CAPP, mach inability data systems, computer generated time Standards. **Computer Integrated production Management systems:** Production planning & control, traditional PPC, Block diagrams CIPMS,	**8**
Module IV **Inventory management & MRP**. Inventory management. MRP. Basic MRP concepts Inputs to MRP, Benefits of MRP .Functions of Shop floor control .shop floor control system. Operating scheduling. computer process monitoring. **Computer process Interfacing** Introduction ,Manufacturing process data, system interpretation of process data computer process control	**8**
Module V **Computer process control;** Introduction structural model of manufacturing process control strategies, distributed control Vs central control, Direct digital control, supervisory computer control **Computer aided Quality Control** : Introduction, terminology in QC, computer in QC, contact inspection methods (optical), Non contact inspection methods (non-optical). Computer aided testing	**9**
Question paper pattern: **CIE:** Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.	

SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:

CAD/CAM Computer aide design and manufacturing; By MikellP. Groover .Emory W. Zimmers

Reference Books:

1. CAD/CAM Principles and application. By P.N.RAO
2. CAD/CAM Technology of computer aide design and manufacturing; By Surinder Kumar. A.K Jha

E books and online course materials: NPTEL

Course outcomes:

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

Course Code	CO #	Course Outcome (CO)
19IP45	CO1	Identify the elements of manufacturing automation
	CO2	Describe design process sequence
	CO3	Describe the process plan for Simple component
	CO4	Solve simple manufacturing material control Problems using the concepts of MRP.
	CO5	Describes principles of quality engineering and the various methods of automate inspection systems

Course title: Thermodynamics and Heat Transfer			
Course code:	16IP46	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: Elements of mechanical engineering			

Course Objectives:

- To learn fundamental concepts of thermodynamics, temperature and the principles of work and energy.
- To acquire knowledge about the fundamentals of thermodynamic laws.
- To understand the application of various heat transfer fundamentals and correlations in engineering applications.
- To learn the thermal analysis of heat exchangers.

Modules	Teaching hours
Module I **Fundamental concepts and definitions:** Fundamental concepts-introduction, concept of pressure, volume, specific volume, density, 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, quasistatic process, energy interactions- work transfer, heat transfer , work and heat transfers are path functions, pdv work in different quasi static processes. **Temperature and Zeroth law of thermodynamic**s: Concept of temperature, Zeroth law of thermodynamics, measurement of temperature, temperature scales, comparison of thermometers, gas thermometers, electrical resistance thermometer, thermocouple, international temperature scale.(Numerical)	**8**
Module II **First law of thermodynamics**: First law of thermodynamics for a closed system undergoing a cycle and a change of state, energy – a property of a system, enthalpy, specific heat at constant volume and pressure, perpetual motion machine of first kind (PMMI) (Numerical) **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 (Numerical)	**8**
Module III **Second law of thermodynamics** : Qualitative difference between heat and work, Thermal energy reservoirs, Kelvin Planck and Clausius statement of the second law , perpetual motion machine of second kind (PMMII), refrigerator and heat pump, equivalence of Kelvin – Planck and Clausius statements, reversibility and irreversibility, causes of reversibility Carnot cycle, reversed heat engine Carnot theorem, corollaries of Carnot's theorem.(Simple numerical) **Entropy and Introduction to heat transfer:** Two reversible adiabatic paths cannot intersect each other, Clausius theorem, the entropy a property. Importance of heat transfer in engineering field, modes of heat transfer, basic laws of heat conduction, convection, and radiation Thermal resistance, conductance and diffusivity (Simple numerical)	**9**
Module IV	**9**

Conduction heat transfer: One dimensional steady state heat conduction, electrical analogy, steady state heat conduction through plane slab or wall, cylinder, sphere, without heat generation, steady state heat conduction through composite structures like slab or wall, cylinder, and sphere. Extended surfaces- introduction, and types of fins, effectiveness and efficiencies of fins, (Numerical) **Convection heat transfer:** Types of convection heat transfer, new tons law of convection, heat transfer coefficients, empirical relations for forced and free convection. (No derivations and only numerical).	
Module V **Radiation heat transfer:** Thermal radiation, definitions of various terms used in radiation heat transfer, Stefan Boltzmann law, Kirchhoff's law, Planck's law, Wein's displacement law and Lambert's Cosine law. (Numerical) **Heat exchangers:** Classification of heat exchangers, Overall heat transfer coefficient, Fouling and fouling factor, LMTD method of heat exchanger analysis (parallel and counter flow with derivation), Brief introduction of Effectiveness method. (Numerical) [No numerical on effectiveness method]	**8**
Question paper pattern: **CIE:** Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions. **SEE:** There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.	
Text books: 1. Basic and applied thermodynamics- P K Nag, TMH publications. 2. A course in heat and mass transfer - S C Arora and S Domkundwar, Dhanpatrai publications.	
Reference Books: 1. Basic thermodynamics – R Yadav 2. Basic thermodynamics – M K Muralidhar. 3. Heat transfer- A basic approach – Ozisik, Tata McGraw Hill 2002 4. Heat transfer, a practical approach – Yunus A Cengel, Tata McGraw Hill 5. Thermal Engineering by R K Rajput, Laxmi publications pvt Ltd, New Delhi	
Course outcomes: On completion of the course, the student will have the ability to:	

Course Code	CO #	Course Outcome (CO)
19IP46	CO1	State and define thermodynamic terminology, Explain Concept of Work and Heat, concept of temperature.
	CO2	Discuss first law of Thermodynamics and Analyze nozzle, throttling device, turbines and compressors and heat exchangers applying first law of thermodynamics
	CO3	Heat engine and refrigerators analysis using Second Law of thermodynamics, Brief about Entropy concepts. Study fundamentals of heat transfer
	CO4	Analyze one dimensional steady state heat conduction and heat transfer in extended surfaces
	CO5	Explain radiation heat transfer, Analyze heat exchangers

Course title: CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS

Course code:	19HU47	Credits:	NCMC
Teaching hours/week:	02	Total teaching hours:	28
CIE: 50 marks	SEE: 50 marks	SEE: 02 hours	

Prerequisite: None

Course Objectives :

To enable the students to obtain the basic knowledge about The Constitution of India and Professional Ethics in the following topics:

. Introduction and Fundamental Rights
. Directive Principles of the State Policy and the State Executive
. The Union Executive
. Constitutional Provisions for women, Children & SC/ST 'S , Emergency Provisions and Election Process
. Engineering Ethics

Modules	Teaching hours
MODULE – I **Introduction and Fundamental Rights** : The Constitution of India. Evolution of the Constitution. The Constituent Assembly of India. Sources and Features of the Indian Constitution. Preamble to the Constitution of India. Salient Features of Fundamental Rights and their classification. General exercise of Fundamental Rights and their	**6 hrs.**

limitations. RTI (Right to Information Act of 2005 Under Article 19(1)) and The Right of Children to Free and Compulsory Education Act or Right to Education Act (RTE) Under Article 21-A of the Constitution. Article 371(J) of the Constitution applicable to Hyderabad Karnataka Area.	
MODULE – II **Directive Principles of the State Policy and The State Executive**: Under Article 36 to 51 of The Constitution and their Relevance. Fundamental Duties Under Article 51A of The Constitution and their Relevance. State Government - The Governor- Appointment, Powers and Functions of the Governor. The Appointment of Chief Minster, his Powers and Functions. The State Council of Ministers and their Functions. The State legislature and The State Council. The High Court of the State, its Powers and Jurisdiction. Appointment and Qualifications of High Court Judges.	**6 hrs.**
MODULE – III **The Union Executive**: Central Government. The President of India, his Election, Powers and Functions. The Vice-President of India, his Election, Powers and Functions. The Supreme Court of India and its Structure. Appointment and Qualification of Supreme Court Judges. Their Powers and Functions. The Structure of Judiciary in India. The Parliament of India. The Prime Minister, his Appointment, Powers and Functions. The Union Council of Ministers their Powers and Responsibilities. Concept of Public Interest Litigation (PIL)	**6 hrs.**
MODULE – IV **Constitutional Provisions and Emergency Provisions and Election Process** : Constitutional for Women, Children, Backward Classes and	**5 hrs.**

Scheduled Caste and Scheduled Tribes under different Article of The Constitution. Different types of Emergencies under Article 352, 356 and 360 of the Constitution of India. The Election Commission of India- its Powers and Functions. The State Election Commission	
MODULE – V **Engineering Ethics :** Its Aims and Scope, Responsibilities of Engineers, Impediments to their Responsibilities, Honesty, Integrity, Reliability, Risk and Safety Measures, Liabilities of Engineers.	**5 hrs.**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

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

Course Code	CO #	Course Outcome (CO)
19HU47	CO 1	Explain the evolution and features of constitution, fundamental rights and their classification
	CO 2	Describe the directive principles of state policy, fundamental duties and The State Executive
	CO 3	Describe about The Union Executive and concept of Public Interest Litigation
	CO 4	Explain the Constitutional Provisions for women, children, SC/ST'S, Emergency Provisions and Election Process
	CO 5	Identifies the qualities required for an professional engineers to be ethical

Course title: Metrology and Measurement lab			
Course code:	19IPL41	Credits:	01
Teaching hours/week:	-	Total teaching hours:	-
Practical ours/week	02	Total practical hours	28
CIE: 50 marks	SEE: 50 marks	SEE: 3 hours	
Prerequisite: -			

Course Objectives:

1. The Metrology and instrumentation Laboratory course is designed for measuring and gauging instruments for inspection of precision linear, geometric forms, angular and surface finish measurements.
2. The student can learn the measurements with and calibration of instruments. They also understand the machine tool alignment test.
3. Instrumentation lab introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various instruments for measuring pressure, temperature, displacement, speed, vibration etc.

Course contents	Practical Hours
Module-I METROLOGY 1. Calibration of a micrometer using slip gauges 2. Measurements using optical projector / Tool maker's microscope. 3. Measurements of angle using sine centre/sine bar/bevel protractor. 4. Measurements of alignment using auto collimator. 5. Measurements of cutting tool forces using a) lathe tool dynamometer 6. Measurements of cutting tool forces using a) drill tool dynamometer. 7. Measurements of screw thread parameters using two wire or three wire method. 8. Measurements of surface roughness using mechanical comparator /TalySurf. 9. Measurements of gear tooth profile using Vernier gear tooth callipers. 10. Measurements using optical flats.	**14**
Module-II: **INSTRUMENTATION ENGINEERING.** 1. Calibration of LVDT. 2. Calibration of load cell. 3. Calibration of thermocouple. 4. Calibration of pressure gauge. 5. Calibration of proving ring.	**14**

6. 6. Determination of modulus of elasticity of a MS specimen using strain gauges. 7. Study of stroboscope and measurement of speed of shaft using stroboscope.	

Question paper pattern:

Scheme of Exam:

One Model from part 1	20 Marks
One Model from part 2	20 Marks
Viva Voce	10 Marks

Reference Books:

1. Lab Manual

Course outcomes:

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

Course Code	CO #	Course Outcome (CO)
19IPL41	CO1	Handle different measurement tools and perform measurements
	CO2	Perform calibration and analyze the characteristics of measuring instruments
	CO3	Develop the Skill to use different gauges and determine the surface features and geometry of components
	CO4	Describe and interpret measurement of variable like force, torque and pressure
	CO5	Demonstrate the mechanical measurements and calibrations

Course title: MANUFACTURING PROCESSES-II- LAB			
Course code:	19IPL42	Credits:	01
Teaching hours/week:	-	Total teaching hours:	-
Practical ours/week	02	Total practical hours	28
CIE: 50 marks	SEE: 50 marks	SEE: 30 hours	
Prerequisite: -			

Course Objectives:

- To have detailed study of machine
- To perform various turning, drilling and boring process on lathe
- To study in detail on cutting force and thrust force
- To perform shaping, V and rectangular groove cutting on shaping machine
- To perform gear teeth cutting on milling machine.

Course contents	Practical Hours
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.	14
PART – B Cutting of V Groove/ dovetail / Rectangular groove using Shaping and Cutting of Gear Teeth using Milling Machine.	14

Question paper pattern:

One Model from Part – A 30 marks
One Model from Part – B 10 marks
Viva – Voce 10 marks

Reference Books:
MP-II lab Manual

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

Course Code	CO #	Course Outcome (CO)

19IPL42	**CO1**	Students will show the machining skill by performing machining process on machine tools.
	CO2	Students will demonstrate the ability by preparing models involving various turning process, drilling and boring on lathe
	CO3	Students will perform V rectangular groove on shaping machine
	CO4	Students will demonstrate the ability to analyze and prepare spur on milling machine
	CO5	Students able to do eccentric turning

Course title: Computer Aided Machine Drawing-II			
Course code:	16IPL43	Credits:	02
Teaching hours/week:	01	Total teaching hours:	14
Practical ours/week	02	Total practical hours	28
CIE: 50 marks	SEE: 50 marks	SEE: 3 hours	
Prerequisite: Computer aided machine drawing-I			
Course Objectives: To develop skill to use software to create 3D models of machine components using any CAD (solid works, solid edge, Catia etc.) software			
PART A			**Theory Hours**
Keys & Joints: Sunk key, Parallel key, Taper key, Saddle key, Gib head key and Woodruff key **Riveted Joints:** Single, double and triple riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets) .			06/12
PART B			
Drawing of 3D models of the following machine components (at least two components) i. Protected type flanged coupling ii. Bushed pin type flexible coupling. iii. Knuckle joint, iv. Socket and spigot cotter joint Preparation of production drawing			08/16
Note:			

Internal assessment:

Students first prepare the sketches of the drawing in drawing book and same is drawn using standard CAD software tool. All the sheets must be submitted after the completion of the lab work.

Question paper pattern:

Students have to answer two questions. One question is set for 20 marks and another question is set for 30 marks.

Text books:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. Prof.N.D.Bhat & V.M.Panchal, Computer Aided Machine Drawing, Charotar Publishing House, Bengaluru
3 N. Siddeshwar, P. Kanniah, V.V.S, . 'Machine Drawing',Sastri,published by Tata Mc GrawHill,2006

Reference Books:

2. CAMD lab Manual
1. K.R. Gopala Krishna, Computer Aided Machine Drawing, Subhas Stores, Bengaluru
3. S. Trymbaka, 'A Text Book of Computer Aided Machine Drawing', Murthy, CBS Publishers, New Delhi, 2007
4. Goutam Pohit & Goutham Ghosh, 'Machine Drawing with Auto CAD', 1st Indian print Pearson Education, 2005
5. Sham Tickoo, 'Auto CAD 2006, for engineers and designers'. Dream tech 2005

E books and online course materials: You Tube, Scibd

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

Course Code	CO #	Course Outcome (CO)
19IPL43	CO1	Make sketch and 2d models of shaft keys in cad software
	CO2	Sketching and creating cad models of various types of riveted joints using standard proportions.
	CO3	Design and creating 3-d models of industrial machinery parts like cotter and knuckle joints in cad environment.
	CO4	Analyze & create 3-d models of industrial flange couplings using standards and codes in cad environment.

	CO5	Visual communication in manufacturing by creating production drawing