Semester III

Second Year B. Tech (Mechanical Engineering .): Semester III									
Course Code	**Course Title**	**L**	**T**	**P**	**C**	**Evaluation Scheme for (L T P)**			
						Component	**Exam**	**WT**	**Pass**
MET201 (BS6)	Differential Calculus & Transforms	3	1	-	4	L(100)	FET	20	Min 40
							CAT-I	15	
							CAT-II	15	
							ESE	50	
MET203 (ES8)	Material Science & Metallurgy	3	-	-	3	L(100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	
MET205 (PC1)	Manufacturing Processes	2	-	-	2	L(100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	
MET207 (PC2)	Thermodynamics	3	-	-	3	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	
MET209 (PC3)	Strength of Materials	3	-	-	3	L(100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	
MET211 (PC4)	Workshop Practice III	-	-	2	1	P(100)	FEP	100	Min 40
MET213 (ES9)	Material Science & Metallurgy Lab	-	-	2	1	P(100)	FEP	50	Min 40
							ESE	50	
MET215 (PC5)	Manufacturing Processes Lab	-	-	2	1	P(100)	FEP	50	Min 40
							ESE	50	
MET217 (PC6)	Thermodynamics Lab	-	-	2	1	P(100)	FEP	100	Min 40
MET219 (PC7)	Strength of Materials Lab	-	-	2	1	P(100)	FEP	100	Min 40
MET 221HS4	Environmental Science	1	-	2	NC	L(100)	ESE	100	Min 40
MET223 UC 1	Professional Development Skills I	-	-	2	Audit	P(100)	ESE	100	Min 40
	Total	15	1	14	20	Total Hrs: 30, Total Credits: 20			

L: Lecture, T: Tutorial, P: Practical, C: Credits, WT: Weight
PC: Program Core, PE: Program Elective, UC: University Core, UE: University Elective
ST: School of Technology, SS: School of Sciences, SC: School of Commerce, SM: School of Management, SA: School of Arts
FET: Faculty Evaluation Lecture, FEP: Faculty Evaluation Practical, ESE: University Evaluation Practical

Second Year B. Tech (Mechanical Engineering): Semester IV

Course Code	Course Title	L	T	P	C	Evaluation Scheme			
						Component	Exam	WT	Pass
MET02 (BS 7)	Numerical Methods and Statistics	3	1	-	4	L(100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	
MET04 (ES 10)	Electrical Technology & Electronics	3	-	-	3	L(100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	
MET06 (PC8)	Kinematics of Machines	3	-	-	3	L(100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	
MET08 (PC9)	Fluid Mechanics	3	-	-	3	L(100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	
MET10 (PC10)	Metrology	2	-	-	2	L(100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	
MET12 (PC11)	Machine Drawing & CAD Lab	-	-	4	2	P(100)	FEP	50	Min 40
MET14 (PC12)	Workshop Practice IV (Basic CNC)	-	-	2	1	P(100)	FEP	50	Min 40
							ESE	50	
MET16 (PC13)	Computer Programming Lab	-	-	2	1	P(100)	FEP	50	Min 40
							ESE	50	
MET18 (ES 11)	Electrical Technology & Electronics Lab	-	-	2	1	P(100)	FEP	100	Min 40
MET20 (PC14)	Kinematics of Machines Lab	-	-	2	1	P(100)	FEP	100	Min 40
MET22 (PC15)	Fluid Mechanics Lab	-	-	2	1	P(100)	FEP	100	Min 40
MET24 (PC16)	Metrology & Mechanical Measurement Lab	-	-	4	2	P(100)	FEP	50	Min 40
							ESE	50	
MET 224 UC 2	Professional Development Skills II	-	-	2	Audit	P(100)	ESE	100	Min 40
	Total	14	1	18	24	Total Hrs: 33, Total Credits: 24			

L: Lecture, T: Tutorial, P: Practical, C: Credits, WT: Weight
PC: Program Core, PE: Program Elective, UC: University Core, UE: University Elective
ST: School of Technology, SS: School of Sciences, SC: School of Commerce, SM: School of Management, SA: School of Arts
FET: Faculty Evaluation Lecture, FEP: Faculty Evaluation Practical, ESE: University Evaluation Practical

DETAILED SYLLABUS FOR S.Y. B. TECH. (MECH. ENGG.)
S. Y. B. Tech. (Mech. Engg.) Semester III

MET01 -BS6: Differential Calculus &Transforms (School of Science)

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Differential Calculus &Transforms	3	1	-	4	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Prerequisites: FYT 101Matrices & Multivariable Calculus, FYT 122 Complex Numbers & Calculus

Course Outcomes: At the end of this course students will able to

CO1 :	**Solve** [3] LDE with constant coefficients.
CO2 :	**Apply** [3] the methods of solution of Linear differential equations with constant coefficients for solving problems in Mechanical Engineering field.
CO3 :	**Solve** [3] Partial Differential Equations.
CO4 :	**Apply** [3] the techniques to find Laplace transforms
CO5 :	**Apply** [3] the techniques to find Inverse Laplace Transforms
CO6:	**Examine** [4] periodic function as a Fourier series.

Syllabus (Theory)

Units	Description	Hours
I	Linear Differential Equations (LDE): Linear Differential Equations with constant coefficients Definition, Complementary function and Particular integral (without method of variation of Parameters), Homogeneous Linear differential equations	8
II	Applications of Linear Differential Equations with Constant Coefficients The Whirling of Shafts. Mass – spring Mechanical system. Free oscillations Damped Oscillations. Forced oscillations without damping	6
III	Partial Differential. Equations Four standard forms of PDE of first order.	6
IV	Laplace Transform: Definition, Transforms of elementary functions, Properties of Laplace transform. Transforms of derivatives and Integral. Transforms of periodic function.	8
V	Inverse Laplace transforms formulae; Inverse Laplace transforms by using partial fractions and Convolution theorem. Solution of Linear differential equation with constants coefficients by Laplace transforms method.	6
VI	Fourier Series: Definition, Euler's Formulae, Dirichlet's Condition. Functions having points of discontinuity, Change of interval, Expansion of odd and even periodic functions, Half range series	6

MET01 -BS6: Differential Calculus &Transforms

References:

Sr. No.	Title of Book	Author	Publisher/Edition
1	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publishers, Delhi.
2	A text book of Applied Mathematics, Vol.-I,II,III	P. N. Wartikar& J. N. Wartikar	Pune VidyarthiGrihaPrakashan, Pune.
3	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley India Pvt. Ltd.
4	Advanced Engineering Mathematics	H. K. Das	S. Chand Publication
5	Mathematical methods of Science and Engineering	Kanti B. Datta	Cengage Learning
6	Engineering Mathematics	V. Sundaram	Vikas Publication
7	Advance Engineering Mathematics	Merle C. Potter	Oxford University Press

MET03: Material Science and Metallurgy

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Material Science & Metallurgy	3	-	-	3	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Description: Understanding the properties of engineering materials and their metallurgy is essential to developing new and improved products. Materials engineers work at the forefront of new technology, with designers and engineers of every discipline, to understand the needs of the product being designed. The course familiarizes the students with the fundamental concepts of materials science and metallurgy useful for material selection. The course deals with the types of materials, structure, properties, their equilibrium diagrams, characteristics and applications, with special emphasis between their relationships. It includes heat treatment for metals and alloys for particular application. This course also contains study of powder metallurgical technique and manufacturing steps of powder metallurgy products.

Course Prerequisites: Applied Chemistry FYT 103, Applied Physics FYT102

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Explain** [2] the properties and applications of various engineering materials.
CO2 :	**Interpret**[2] equilibrium diagram and microstructures of various types of steels.
CO3 :	**Explain** [2] types of Cast irons, their properties, applications and microstructures.
CO4 :	**Select** [3] appropriate heat treatment for metals and alloys for particular applications on the basis of TTT, CCT curves.
CO5 :	**Explain** [2]mechanical testing methods for various metallic materials.
CO6:	**Explain** [2] powder metallurgy technique, manufacturing of typical P/M products.

MET03: Material Science and Metallurgy

Unit No.	Contents	Lecture Hrs
Unit 01	**Engineering Materials** Overview of Metallic Materials: Ferrous and Non Ferrous Metals, Ceramics- Traditional and Engineering Ceramics, Polymers: Traditional and Special Polymers, Composites: Ceramic- Metal-Polymer composites, Carbon nano tube composites.	6
Unit 02	**Plain Carbon and Alloy Steels** Type of equilibrium diagrams in metals and alloys, lever rule. Iron - Carbon equilibrium diagram, critical temperatures. Allotropy, cooling curve and volume changes of pure iron. Microstructures of slowly cooled steels, estimation of carbon from Microstructures, non-equilibrium cooling of steels, Effects of alloying elements and examples of alloy steels. Stainless steels. Tool steels and tool materials. Applications of plain carbon and alloy steels, specifications of commonly used steels for engineering applications (e.g. EN, DIN, IS etc. with examples)	8
Unit 03	**Cast Irons** Classification of Cast irons: Gray cast irons, nodular cast irons, white cast irons, malleable cast irons, chilled. Effect of various parameters on structure and properties of cast irons. Applications of cast irons for different components of machine tools, automobiles, pumps, etc.	5
Unit 04	**Heat Treatment of Steels** Transformation products of austenite, Time temperature Transformation diagrams, Critical cooling rate, continuous cooling transformation diagrams. Heat treatment of steels, Cooling media. Annealing, normalizing, hardening. Tempering, Carburising, Nitriding, Carbonitriding, Flame and Induction hardening. Commercial heat treatment practice of gears of different sizes, tools, lathe beds, springs, etc.	8
Unit 05	**Mechanical Testing** Tension test - Engineering and true stress strain curves, Compression test, Hardness Tests: Brinell, Rockwell, Vickers, Hardness conversions, Impact test, Non Destructive Testing: Magnetic Particle test, Dye penetrant, ultrasonic tests, radiography and eddy current testing.	6
Unit 06	**Powder Metallurgy** Sintered structural components, Advantages and Limitations of powder metallurgy, powder manufacture, testing and characterization, Manufacturing of typical P/M products: cemented carbides, cermets, sintered carbide cutting tools, diamond impregnated tools, sintered metal friction materials and self- lubricating bearings.	6

MET03: Material Science and Metallurgy

Sr. No.	Text Books
01	D. R. Askland& P. P. Phule, "Material Science & Engineering of Materials", by Cengage Learning Center India Pvt Ltd., 6/e, 2011
02	S.H. Avner, Introduction to Physical Metallurgy, Tata McGraw Hill Publ. Co., 2/e 1997.

Sr. No.	Reference Books
01	R. Balasubramaniam,Callister's Materials Science and Engineering, Wiley India Pvt. Ltd., 2008.
02	V. Raghvan, "Materials Science & Engineering", PHI 5th Edition, Prentice-Hall of India (P) Ltd.
03	W. Callister, "Materials Science & Engineering", John Wiley & sons
04	R. A. Higgins, Engineering Metallurgy Part-I, Applied Physical Metallurgy, ELBS with Edward Arnold, 6/e, 1993.
05	K. Bhargava, Mechanical Behaviour and Testing of Materials by and C. P. Sharma, Publication PHI 2011.

MET05: Manufacturing Processes

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Manufacturing Processes	2	-	-	2	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Contents: Any mechanical product needs to be manufactured using one or more processes before selling it in the market. This course imparts basic knowledge of different manufacturing processes such as, turning, planning, drilling, milling and metal forming processes like forging, rolling, extrusion, and casting. It also includes plastic molding processes and non-conventional machining processes.

Course Prerequisites: Workshop Practice I & II: FYT 120 & FYT 126

Course Co-requisites:- --

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Explain** [2] principles and applications of metal cutting processes like turning and planing.
CO2 :	**Explain** [2] principles and applications of metal cutting processes like drilling and milling.
CO3 :	**Explain** [2] principles and applications of metal forming processes like forging, rolling, extrusion and drawing.
CO4 :	**Outline** [2] principles and applications of casting and plastic molding processes.
CO5 :	**Explain** [2] principles and applications of sheet metal processes.
CO6:	**Outline** [2] principles and applications of non-conventional machining.

Unit No.	Contents	Lecture Hrs
01	**Metal Cutting Processes-I**(Applications to be discussed) a. Centre lathe, lathe operations, taper turning, methods of taper turning, work holding and cutting tool, thread cutting, machining time and power estimation b. Shaping Machine - Types-crank shaper, hydraulic shaper, Crank and slotted link quick return mechanism, Table feed mechanism, Various operations. c. Planing Machine- Types-standard double housing planer, principle parts, table drive and feed mechanism, Various operations.	5
02	**Metal Cutting Processes-II**(Applications to be discussed) a. Drilling machine, its types, twist drill, drilling time and power estimates,	5

	counter boring, spot facing, boring, reaming, tapping, and broaching, broach tool, broaching types and operations, Sawing Machine - Types, Operations b. Milling machine and its types, milling operations, milling cutters, milling time and power estimates, Gear cutting using indexing mechanism, indexing types - simple, compound and differential indexing.	
03	**Metal Forming Processes**(Applications to be discussed) a. Rolling – Introduction, Hot and cold Rolling, Classification of Rolling Mills, Defects in Rolling, b. Forging- Introduction, Hand Forging Operations, Forging Machines (board Hammer, Air and Steam, Hydraulic Hammer) Open and Closed Die Forging, Defects in Forging c. Extrusion- Introduction, Types – Direct, Indirect, Tube, Impact and Hydraulic Extrusion, Defects in Extrusion d. Drawing – Processes of wire, rod and pipe drawing, Defects in Drawing.	5
04	**Metal Shaping Processes**(Applications to be discussed) a. Introduction to casting processes : Patterns, Cores, core prints, sand casting procedure, Specialized casting processes such as shell mould casting, die casting, centrifugal casting, investment casting and permanent mould casting b. PlasticsProcessing: Molding – Compression molding, Transfer molding, Blow molding, Injection molding – Process and equipment. Extrusion of Plastic – Type of extruder, extrusion of film, pipe, cable and sheet Thermoforming – Principle, pressure forming and vacuum forming	4
05	**Sheet Metal Working:**(Applications to be discussed) Types of sheet metal operations, Types of dies and punches, material for dies and punches, Die design for Progressive and Drawing Die, clearance analysis, center of pressure, blank size determination (Numerical), strip layout, sheet utilization ratio (Numerical), method of reducing forces	3
06	**Non-Conventional Machining Processes:**(Applications to be discussed) Classification, selection of process, Electro Discharge Machining, Electro Chemical Machining, Ultra Sonic Machining, Electron Beam Machining, Laser Beam Machining, Abrasive Jet Machining	3

MET05: Manufacturing Processes

Sr. No.	Text Books
01	A Textbook of Production Technology (Manufacturing Processes) by P.C. Sharma
02	Manufacturing Technology- Foundry, Forming and Welding by P. N. Rao, Tata McGraw-Hill

Sr. No.	Reference Books
01	J. T. Black – Degormos, Materials and process in manufacturing – John Willey and Sons.
02	M.P Grover – Fundamentals of modern manufacturing: Materials and systems
03	A.S Athalye – Processing of Plastic– Colour Publication (Pvt.) Ltd. U.K
04	Dr. R. S. Parmar, Welding Processes And Technology, Khanna Publishers, New Delhi.

MET07: Thermodynamics

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Thermodynamics	3	-	-	3	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Contents:

The aim of this course is to provide students with the basic concepts of thermodynamic systems, and their applications, such as, work, heat, energy, entropy and enthalpy. It also discusses First law and second law of thermodynamics and their applications to various systems, fuels and combustion efficiency, properties of pure substances steam on p-v, T-s, and h-s diagrams, laws of ideal gases, principles of Jet Propulsion.

Prerequisite: FYT105 Elements of Mechanical Engineering

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Classify**[2] types of systems and their relative properties,
CO2 :	**Apply**[3] the concept of First law of thermodynamics to design simple systems.
CO3 :	**Apply**[3] the concept of second law of thermodynamics to design simple systems.
CO4 :	**Explain**[2] the significance of Entropy and principle of entropy generation.
CO5 :	**Solve**[3] simple numerical problems on combustion and stoichiometry.
CO6:	**Apply**[3] gas laws to mixtures with phase change diagrams of various pure substances.

Unit No.	**Contents**	Lecture Hrs
Unit 01	**Fundamental Concepts and Definitions**-Thermodynamic systems; properties, processes and cycles. Thermodynamic equilibrium, Quasi-static process, Macroscopic v/s Microscopic viewpoint, Work and heat Transfer: Work transferred and other types of work, Heat transfer, temperature and its measurement (principle of measurement, various instruments, etc.). Zeroth law of thermodynamics, specific heat and latent heat, point function, path function.	**07**
Unit 02	**First Law of Thermodynamics** First law of thermodynamics for a closed system undergoing a cycle and change of state, Energy, Enthalpy, PMM-I control volume.	**06**

	Application of first law of steady flow processes (nozzle, turbine, compressor, pump, boiler, throttle valve etc.)	
Unit 03	**Second Law of Thermodynamics** Limitation of first law of thermodynamics, cycle heat engine, refrigerator and heat pump, Kelvin-Plank and Clausius statements and their equivalence, Reversibility and Irreversibility, Carnot cycle, Carnot theorem.	**06**
Unit 04	**Entropy** Introduction, Clausius theorem, T-s plot, Clausius inequality, Entropy and Irreversibility, Entropy principle and its application, combined I and II law, Entropy and direction.	**05**
Unit 05	**Combustion Thermodynamics**: Theoretical (Stoichiometric) air for combustion of fuels. Excess air, mass balance, Exhaust gas analysis, A/F ratio. Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion. Combustion efficiency. **Jet propulsion:** Introduction to the principles of jet propulsion, turbojet, turboprop, Ramjet and turbofan engines and their processes. Principles of rocket propulsion, Introduction to rocket engine.	**08**
Unit 06	**Ideal Gas-** Avogadro's law, Equation of state, ideal gas and process, relation between C_p and C_v, other equation of states. **Properties of Pure Substance:** Phase change of pure substance, phase diagram of pure substance, p-v, T-s, and h-s diagrams properties of steam, property table, representation of processes of steam on p-v, T-s, and diagrams, Dryness fraction and its measurement.	**07**

Sr. No.	**Text Books**
01	Basic and Applied Thermodynamics" by P.K. Nag, Tata McGraw Hill,2/e, 2009
02	Thermodynamics: an engineering approach, by Yunus A. Cenegal and Michael A. Boles,Tata McGraw Mill Publ. Co., 6/e, 2008.

Sr. No.	**Reference Books**
01	An Introduction to Thermo Dynamics by Y.V.C. Rao, Wiley Eastern Ltd, 2003.
02	G. J. Van Wylen, R.E. Sonntag, "Fundamental of Thermodynamics", John Wiley and Sons, 5/e,1998.
03	Thermodynamics by Radhakrishnan. PHI, 2/e revised.
04	Thermal Engineering by R.K. Rajput, Laxmi Publications, 9/e, 2013.

MET09: Strength of Materials

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Strength of Materials	3	-	-	3	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Contents:

This course enables student to evaluate different types of stresses and strains generated in mechanical components due to different types of loads in working; Involves calculations of stresses in beam and columns; Study of concept of principle stresses and strains and its application in design of mechanical components; Analysis of shafts and columns of different cross sections for strength and failure analysis of structures and transmission members.

Course Prerequisites: FYT 108 Engineering Mechanics

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Explain**[2] concepts of stress and strain
CO2 :	**Demonstrate**[2] principle stresses on any given plane
CO3 :	**Illustrate**[2] shear force and bending moment diagrams for different types of beams
CO4 :	**Solve** [3] numerical assignments on bending and shear stresses for different cross sections
CO5 :	**Solve** [3] numerical assignments on slope and deflection of beam for different types of load
CO6:	**Solve** [3] numerical assignments on torque in shaft of circular cross section

Unit No.	**Contents**	Lecture Hrs
Unit 01	**Simple stresses and strains**:	06
	Basic Concept of stress and strain (linear, lateral. shear and volumetric), Hooke's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, stress strain diagrams for ductile and brittle materials, factor of safety, working stress, Hooke's law, bulk modulus, interrelation between elastic constants**.** Stresses, strains & deformations in determinate and indeterminate problems, homogenous and composite bars under concentrated loads and temperature changes.	
Unit 02	**Transformation of Stresses and Strains**	06
	Normal and shear stresses on any oblique plane. Concept of principal planes. Derivation of expressions for principal stresses and maximum shear stress, position of principal planes and planes of maximum shear, graphical solution using Mohr's circle of stresses.	

Unit 03	**Transversely Loaded Components**	08
	Shear Force and Bending Moment in Determinate Beams due to Concentrated Loads, Uniformly Distributed Loads. Relation between SF and BM Diagrams for Cantilevers, Simple and overhang Beams, Defining Critical and Maximum Values and Positions of Points of Contra Flexure	
Unit 04	**Bending stresses and Shear stresses:**	08
	Theory of simple bending, assumptions, derivation of flexure formula, second moment of area of common cross sections with respect to centroidal and parallel axes, Bending stress of symmetrical and unsymmetrical sections. Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress.	
Unit 05	**Slope and deflection of Beams:**	06
	Relation between BM and slope, slope and deflection of determinate beams, Double Integration Method (Macaulay's Method). Derivation of Formulae for Slope and Deflection for Standard Cases(point load and uniformly distributed load - UDL).	
Unit 06	**Torsion of circular shafts and Buckling of Columns**	06
	Basic assumptions, Torsion formula, Hollow and solid circular shafts, Angular deflection of shaft. Concept of buckling of columns. Derivation of Euler's formula for buckling load for column with hinged ends. Concept of equivalent length for various end conditions. Limitations of Euler's formula. Rankine's formula. Johnson's formula, safe load on columns.	

Sr. No.	**Text Books**
01	"Strength of Materials", R.K. Rajput, S. Chad Publication.
02	"Strength of Materials", R. K. Bansal, Laxmi Publication, 4th Edition.
03	"Strength of Materials", Timoshenko and Young, CBS Publication.

Sr. No.	**Reference Books**
01	"Strength of Materials", Beer and Johnson, CBS Publication.
02	"Strength of Materials", G.H. Rider,MacMillan India Ltd.
03	"Strength of Materials", Nag and Chanda, Willey India Publication.
04	"Advanced Mechanics of Materials", Boresi, Willey India Publication.
05	"Strength of Materials", Den Hartong, McGraw Hill Publication.
06	"Mechanical analysis and design", H. Burr and John Cheatam, PHI, New Delhi.

MET11: Workshop Practice III

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Workshop Practice III	-	-	2	1	P(100)	FEP	100	Min 40

Course Contents: This course contains hands on working on machines like lathe, drilling, shaping and grinding to make simple components. It familiarizes the student with practices in workshop, machines, tools and the measurement of dimensions.

Course Prerequisite: Workshop Practice I and II: FYT 120 and FYT126

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Make use of** [3] Lathe machine and accessories to make a simple component as per the drawing.
CO2 :	**Make use of** [3] drilling machine and accessories to make a simple component as per the drawing.
CO3 :	**Make use of** [3] shaping machine and accessories to make a simple component as per the drawing.
CO4 :	**Make use of** [3] grinding machine and accessories to make a simple component as per the drawing.

Sr. No.	**Term Work**
01	One job on Lathe: plain turning, taper turning, external threading and knurling operation along with preparation of its process sheet.
02	One job on Drilling machine involving drilling, countersinking, counter boring, reaming and tapping,
03	One job on Shaper involving various operations on shaping machine.
04	One job on grinding machine – Cylindrical, surface and center less grinding

Sr. No.	**Text Books**
01	S. K. HajraChoudhury, Elements of Workshop Technology – Vol. II, Media Promoters & Publishers, Mumbai
02	Production Technology-HMT, Tata McGraw-Hill Publishing Co. Ltd.

MET13: Material Science and Metallurgy Lab

Course	L	T	P	C	Evaluation Scheme			
					Component	Exam	WT	Pass
Material Science & Metallurgy Lab	-	-	2	1	P(100)	FEP	50	Min 40
						ESE	50	

Course Contents:

Understanding the properties of engineering materials and their metallurgy is essential to developing new and improved products. Materials engineers work at the forefront of new technology, with designers and engineers of every discipline, to understand the boundaries of science and engineering. One of the main objectives of the course is to familiarize the students with the materials science and metallurgy laboratory for the understanding of practical knowledge of the subject. This course gives students an opportunity to perform practical on Universal tensile test machine, hardness test machine, impact test machine. It also provides to conduct non-destructive testing. This course contains study and applications of different heat treatment for steels.

Course Co-requisites: MET03: Material Science and Metallurgy

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Interpret**[3] the findings of hardness test, tensile test and Charpy&Izod impact test.
CO2 :	**Interpret** [3[the findings of Magnaflux test and Dye penetrant.
CO3 :	**Interpret**[3]the microstructures observed and drawn from plain carbon steel samples.
CO4 :	**Compare**[2] types of heat treatments on steel samples prepared in laboratory.
CO5 :	**Interpret**[3] the microstructures observed and drawn from cast iron samples.

MET15: Manufacturing Processes Lab

Course	L	T	P	C	Evaluation Scheme			
					Component	Exam	WT	Pass
Manufacturing Processes Lab	-	-	2	1	P(100)	FEP	50	Min 40
						ESE	50	

Course Contents: This course contains study and demonstration of machines like grinding machines, gear manufacturing machines and mold making processes. It also includes design of dies simple sheet metal parts; and visits to industries for understanding the processes better.

Course Prerequisites: Workshop Practice I & II: FYT 120 & FYT 126

Course Co-requisites: Manufacturing Processes MET05.

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Explain** [2] principles of grinding processes and types of grinding machines.
CO2 :	**Explain** [2] principles of gear manufacturing processes.
CO3 :	**Outline** [2] the process plan required to manufacture a given component.
CO4 :	**Demonstrate** [2] different molding methods in metal casting.
CO5 :	**Illustrate** [2] die design process for a given simple sheet metal component.
CO6:	**Summarize** [2] molding process for a rolled/forged/sheet metal component manufactured in an industry.

Sr. No.	Experiments to be performed and report to be submitted in prescribed format.
01	Study of Grinding Machine, Construction of grinding wheel, its types, materials, Standard nomenclature
02	Study of various Gear Manufacturing Methods
03	Preparation of process planning sheet for a job including processes such as turning, milling and drilling.
04	Mold Making process
05	Sheet Metal Die design for simple object
06	Industrial Visit to Rolling mill, Forging and press work.

MET17: Thermodynamics Lab

Course	L	T	P	C	Evaluation Scheme			
					Component	Exam	WT	Pass
Thermodynamics Lab	-	-	2	1	P(100)	FEP	100	Min 40

Course Contents:

Conducting the tests of different properties of lubricants such as Viscosity, flash and fire point, carbon residue, aniline and drop pint, cloud and pour point, penetration number, Trial on Exhaust gas analyzer, steam power plant and Demonstration of jet propulsion engine

CoursePrerequisite: FYT105 Elements of Mechanical Engineering,

Course Co-requisite: MET07 Thermodynamics

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Interpret** [3]the various properties of lubricants by conducting the tests in laboratory.
CO2 :	**Examine**[3]exhaust gas for emission measurement in a laboratory setup.
CO3 :	**Explain**[1] the working of Jet propulsion Engines and steam power plants.

Sr. No.	Experiments to be performed and report to be submitted in prescribed format.
01	Test on Grease penetrometer and dropping point apparatus
02	Test on Carbon residue, Cloud and Pour point apparatus.
03	Test on Red wood viscometer and Aniline point apparatus.
04	Determination of flash and fire point of a lubricating oil.
05	Trial on Exhaust gas analyzer.
06	Study of Jet propulsion Engines.
07	Study / Trial on steam power plant.
08	Industrial visit to a steam power plant.

MET19: Strength of Materials Lab

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Strength of Materials Lab	-	-	2	1	P(100)	FEP	100	Min 40

Course Contents:

This course enables student to practice variety of numerical for calculation of stress and strain and its transformation in principle stress and principle strain; draw shear force and bending moment diagrams for different types of beams and of different cross sections.

Course Requisite: FYT 108 Engineering Mechanics

Course Co-requisite: MET 09 Strength of Materials

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	Solve [3] problems of stress and strain.
CO2 :	Calculate [3] principle stresses on any given plane.
CO3 :	Solve [3] numerical exercises on Shear force and bending moment diagrams for different types of beams.
CO4 :	Calculate [3] bending and shear stresses for different cross sections of beams.
CO5 :	Calculate[3] slope and deflection of beam for different types of load
CO6:	Calculate [3] torque in shaft of circular cross section.

Sr. No.	Numerical assignments to be carried out on following topics, and report to be submitted in prescribed format.
01	Simple stresses and strains
02	Transformation of stresses and strains (principal stresses)
03	Transversely Loaded Components (Shear Force Diagram & Bending Moment Diagram)
04	Bending stresses and shear stresses

05	Torsion of circular shafts
06	Buckling of columns
07	Theories of elastic failure
08	Strain energy and impact loading

MET 221: Environmental Science

S. Y. (B. Tech) Semester I/II										
Course Code	**Course Title**	**L**	**T**	**Pr**	**C**	**Evaluation Scheme**				
						Component	**Exam**	**WT**	**Min Passing**	
(UC|SS) Version: 10	Environmental Studies	3	-	-	3	Th (100)	FET	20	40%	40%
							CAT	30		
							ESE	50	40%	40%
(UC|SS) Version: 1.0	Environmental Studies Project	-	-	2	1	Pr (100)	FEP	100	40	40%

Contents

Units	Description	Hours
I	**a) Introduction to environmental studies:** • Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. **b) Ecosystem:** • Concept of ecosystem, Structure and function of ecosystem; Energy flow in an ecosystem. • Food chains, food webs and ecological succession. • Structure and function of the following ecosystems: Examples	1 2
II	**a) Natural Resources: Renewable and Non- Renewable Resources** • Land resources and land use change; Land degradation, soil erosion and desertification. • Deforestation: Causes and impacts due to mining, dam building on environment and forests • Water: Use and over-exploitation of surface and ground water, floods, droughts • Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies **a) Biodiversity and Conservation** • Levels of biological diversity: genetic, species and ecosystem diversity; • Global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India • Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions. • Conservation of biodiversity In-situ and Ex-situ conservation of biodiversity.	2 3

	• Ecosystem and biodiversity services: Ecological, economic, social, ethical, Aesthetic and Informational value.	
III	**a) Environmental Pollution** • Environmental pollution: types, causes, effects and controls; Air, water, Noise pollution • Nuclear hazards and human health risks • Solid waste management: Control measures of urban and industrial waste. **b) Environmental policies and practices** • Global issues: Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. • Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act	3 3
IV	**a) Human Communities and the Environment** • Human population growth: Impacts on environment, human health and welfare • Disaster management: floods, earthquake, cyclones and landslides. • Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. • Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).	3

Environmental Studies Project (Field Work)

(Ver 1.0, Program Core, School of Sciences)

Lect.	Tut.	Practical.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass
-	-	2	0	Practical (100)	PET	100%	Min 40

Field Work

Description
• Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. • Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural. • Study of common plants, insects, birds and basic principles of identification. • Study of simple ecosystems-pond, river, etc.

References

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
7. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Deeksha Dave, S.S. Katewa, Textbook of Environmental Studies.
10. B.K. Sharma, Environmental Chemistry.
11. Bharucha Erach, The Biodiversity of India, Mapin Publishing pvt. Ltd., Ahmedabad 380013, India, Email:mapin@icenet.net (R)
12. De A.K., Environmental Chemistry, Wiley Wastern Ltd.
13. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I anfd II, Environmental Media (R)

MET 223: Professional Development Skills- I

(Ver 1.0, Sem-III of Second Year B. Tech (Common for All Branches)

Course Description: This course aims to prepare the students for soft skills. The course will help them to understand their potential and set goals accordingly and organize their activities to achieve their set goals. The course also focuses on presentation and public speaking.

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

CO01 : apply[3] self analysis techniques

CO02 : plan[4] and execute SMART goals

CO03 : demonstrate[3] team building skills

CO04 : prepare[3] time table and action plan to achieve set goals.

CO05 : exhibit[3] presentation and public speaking skills

Contents

Units	Description	Hrs
I	**Soft Skills:** What are soft skills? Importance of soft skills, selling your soft skills, identifying and improving your soft skills **Self Analysis:** Importance of knowing yourself, SWOT Analysis, Importance of Self Confidence, Self Esteem	04
II	**Goal Setting:** SMART Goals, Short Term goals, Moderate term goals, Long Term, Life Time Goals	04
III	**Team Building and Teamwork:** Introduction-meaning–aspects of team building, team Vs group, Stages of team building, Characteristics of effective team, role of a team leader, role of team members	04
IV	**Time Management:** Value of time, Diagnosing Time Management, Preparing to do list, Prioritizing work	04
V	**Presentation skills and Public Speaking:** Elements of an effective presentation, Structure of a presentation, Presentation tools, Audience analysis, Language: Articulation, Good pronunciation, Voice quality, Modulation, Accent and Intonation. Extempore and Prepared speeches	04

MET 223: Professional Development Skills- I

Note: During the practical sessions, it is expected that the contents of all modules should be delivered to the students of different batches and assignments be given based on the activities discussed as per the modules. Students must demonstrate the acquired skills by means of giving presentations, delivering public speeches, group discussions etc.

References:

1. Wallace & Masters, Personal development for Life & work, Thomson Learning.

2. Barun K. Mitra, Personality Development and Soft- Skills, Oxford University Press.

3. Fred Luthans, Organizational behavior, McGraw Hill.

4. Asa Don Brown, Interpersonal skills in the Workplace, Tate publishing and Enterprises.

S. Y. B. Tech. (Mech. Engg.) Semester IV

MET02: Numerical Methods and Statistics

(Aeronautical, Mechanical, Electrical) (Ver 1.0, Program Core, School of Science)

Course	L	T	P	C	Evaluation Scheme			
					Component	Exam	WT	Pass
Numerical Methods and Statistics	3	1	-	4	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Prerequisites: FYT 101 Matrices & Multivariable Calculus, FYT 122 Complex Numbers & Calculus, MET01 Differential Calculus &Transforms

Course Outcomes: At the end of this course students will able to

CO1 :	**Solve**[3] Algebraic and Transcendental Equations
CO2 :	**Apply**[3] the methods of solution of Simultaneous linear equations
CO3 :	**Express**[2] numerical data as polynomial.
CO4 :	**Apply**[3] the probability distributions.
CO5 :	**Evaluate**[5] derivative and integration
CO6:	**Solve**[3] Ordinary Differential Equation and partial differential equations

Syllabus (Theory)

Units	Description	Hours
I	Algebraic and Transcendental Equations: Introduction, Types of errors, Rules for estimate errors, Roots of Equation by Bisection Method, False position method, Secant method, Newton- Raphson method, multiple roots by Newton method.	8
II	Simultaneous linear equations: Gauss elimination method, Gauss-Jordan method, Factorization method, Gauss- Seidel iterative method, Jacobi iterative method, Relaxation method.	6
III	Interpolation: Introduction, Properties and problems on Finite differences, Interpolation on equal intervals -Newton forward and backward difference formulae, Stirling interpolation formula, Interpolation on unequal intervals- Newton divided difference formula, Lagrange Interpolation.	6
IV	Statistics: Mean, Mode, median, standard deviation, Random variable, Probability mass function and probability density function, Binomial, Poisson and Normal distributions.	8
V	Numerical differentiation and Integration: Newton forward and backward difference formulae for equally spaced data, Derivative using stirling formula, Newton's divided difference formula for unequally spaced data, Derivative using Lagrange Interpolation, Numerical Integration by Trapezoidal rule and Simpson rule for integration and Romberg Integration.	6

VI	Ordinary Differential Equation and partial differential equations: Taylor series method, Picard Method, Euler Method, Euler modified method, second and fourth order Runge-Kutta method,	6

References:

Sr. No.	Title of Book	Author	Publisher/Edition
1	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publishers, Delhi. 7/e,2005
2	Numerical Methods	E. Balguruswamy	Tata McgrawHill Publication Company Ltd.,8/e,2002.
3	Numerical Methods	S. Arumugam, A. Thangapandi Isaac and A.Somasundaram,	Scitech Publications India Pvt.Ltd.,Chennai, 2/e,2007.
4	Numerical Methods	Dr. V.N.Vedamurthy	Vikas Publication
5	Numerical Methods	G.Haribaskaran	Laxmi Publications Pvt.Ltd, New Delhi, 1/e,2006.
6	Numerical Analysis Theory and Applications	R.L.Burden and J.D.Faires	Cengage Learning India Pvt.Ltd.,New Delhi,1/e,2005.
7	Numerical Mathematics and Computing	Ward Cheney	Cengage Learning India Pvt.Ltd.,New Delhi,7/e

MET04: Electrical Technology & Electronics

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Electrical Technology & Electronics	3	-	-	3	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Contents: This course gives brief idea on DC Motors and Three Phase Induction Motors. Also it consist the application of electrical drives. This course describes the Combinational & Sequential Logic Circuits and different types of Sensors and Transducers. This course gives introduction to computer networks and its applications.

Course Prerequisites: FYT 107 Elements of Electrical Engineering, FYT 106Elements of Electronics Engineering

Course Outcomes: After the completion of this course, the student will able to,

CO1:	**Explain** [2] working and characteristics of DC motor.
CO2:	**Explain** [2] working of and control methods for induction motor.
CO3:	**Classify**[2] different types of drives used in industry.
CO4 :	**Explain** [2]various sensors and transducers with their applications
CO5 :	**Illustrate** [2] operation of digital combinational and sequential circuits.
CO6:	**Classify** [2] different computer networks with their types.

Unit No.	**Contents**	Lecture Hrs
Unit 01	**DC motors:** Construction, Working, Types, Back emf, Speed equation, Torque equation, Speed torque characteristics, Applications, Power losses in d.c. Motors. Need of starter, 3 point starter, Speed control of D.C. Shunt and series motor (numerical treatment), Reversal of rotation, Electric braking of shunt and series motor. DC servo motor, Stepper motor (VR type and PM type).	6
Unit 02	**Three Phase Induction Motor:** Construction, Types, Working, Speed equation, Torque equation, Starting torque, Concept of full load torque, Torque speed characteristics, Power stages in motor (Numerical treatment), Need of	10

	starter, Star delta starter, DOL starter, Rotor resistance starter, Variable Frequency Drive speed control method, Block diagram of electronic VFD control, Rotor resistance speed control. Reversal of rotation. AC servo motor, Introduction to BLDC motor and linear induction motor.	
Unit 03	**Electrical Drives:** Advantages of electrical drives, Types – Individual, group, Multi-motor drive. 2 quadrant and 4 quadrant operation of electric machines. Criteria for selection of motors for applications - machine tools,. Determination of power rating of electric motors for continuous duty – Constant load.	4
Unit 04	**Sensors and Transducers** Definition, Various Types of Transducers, Classification of Transducers, Selection Factors and General Applications of Transducers, Detailed Study of Transducers: (i) Motion, (ii) Flow, (iii) Pressure, (iv) Temperature, (v) Force and Torque, (vi) Sound Transducer, Hall Effect Transducers, Digital Transducers, Proximity Devices, optical Sensors, Smart Sensors, Piezo – electric sensors	8
Unit 05	**Combinational & Sequential Logic Circuits:**Adder, Subtractor, Multiplexer and Demultiplexer, encoder, decoder, 4 bit Magnitude Comparator, Sequential circuits - SR Latch, One bit memory cell,JK filp-flop	6
Unit 06	**Introduction to computer networks:** Networks definition &requirements, Networks topologies, LAN,MAN and WAN network, Introduction to OSI,TCP/IP reference model, Modem- block schematic and working, network devices: network connectors, Hubs, Switches, Routers, Bridges, NIC; Introduction to Internet of Things	6

Sr. No.	**Text Books**
01	Electronic Instrumentation. H. S. Kalsi, TMH Publication
02	Digital Design - M. Morris Mano - Pearson Education, 3/e, (Unit 1,2,3,4)
03	Computer networks Andrew S. Tanenbaum, Pearson Education, 5/e.

Sr. No.	**Reference Books**
01	A. Anand Kumar, “Fundamentals of digital circuits” 1/e, PHI publication, 2001
02	A course in Electrical, Electronics Measurement and Instrumentation, A.K.Sawhney

MET06: Kinematics of Machines

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Kinematics of Machines	3	-	-	3	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Contents:

Different engineering applications require different mechanisms to carry out physical functions. This course imparts the basic knowledge of mechanisms & linkages, dynamometers, belts and governors. It includes basic concepts of velocity and acceleration of different kinds of mechanisms, design of cams & follower assembly and its application in mechanisms.

Prerequisite:FYT 108 Engineering Mechanics, MET09 Strength of Materials

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Explain** [2]different types of mechanisms and their applications.
CO2 :	**Construct** [3]velocity and acceleration diagrams.
CO3 :	**Explain** [2] effect of friction in mechanisms and machines.
CO4 :	**Construct** [3]profile of cam and followerfor given applications.
CO5 :	**Illustrate** [2]power transmitting elements according to applications.
CO6:	**Demonstrate** [2]differenttypes of governors.

Unit No.	**Contents**	Lecture Hrs
Unit 01	**Basic Concept of Mechanisms:** Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Grubbler"s criterion, Inversions of slider crank chain, Double slider crank chain, Four bar, Steering gear mechanisms, Analysis of Hooke's joint.	**05**
Unit 02	**Velocity and Acceleration in Mechanisms:**	**10**

	Graphical analysis of Velocity and acceleration for different mechanisms using relative velocity and acceleration method, Coriolis‟ component of acceleration, Klein's construction for slider crank mechanism, Velocity analysis by Instantaneous center method.	
Unit 03	**Friction:** Introduction of friction, Friction in pivot bearings, Inclined plane theory, Friction in screws.	**05**
Unit 04	**Cams:** Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower, Jumping of follower.	**08**
Unit 05	**Belts and Dynamometers:** Types of belt drives, Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt, Classification of dynamometers, Study of rope brake absorption dynamometer and belt transmission dynamometer.	**06**
Unit 06	**Governors:** Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronism, Governor effort and power, Insensitiveness of governors.	**06**

Sr. No.	**Text Books**
01	Theory of Machines, Ratan S.S, Tata McGraw Hill New Delhi, 2nd Edition.
02	Theory of Machines, P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition
03	Theory of Machines, V.P. Singh, DhanpatRai and Sons
04	Theory of Machines, H.G.Phakatkar, Nirali Publication. Pune
05	Theory of Machines, Dr. R.K.Bansal, Laxmi Publication.
06	Theory of Machines, Thomas Bevan, CBS Publishers, New Delhi.
07	Theory of Machines and Mechanism, G.S. Rao and R.V. Dukipatti, "New Age Int.Publications Ltd., New Delhi.
08	Theory of Machines, Shah and Jadhawani, DhanpatRaiand Sons

Sr. No.	**Reference Books**
01	Theory of Machines and Mechanism, Shigley, McGraw Hill, New York
02	Theory of Machines, Abdullah Shariff, McGraw Hill, New Delhi.

MET08: Fluid Mechanics

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Fluid Mechanics	3	-	-	3	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Contents:

This course imparts the basic knowledge of incompressible and compressible fluids, required for designing machinery like pumps, turbines, compressors, lubrication systems, propulsion engines etc. and analysis using techniques like computational fluid dynamics. It includes basic concepts of properties of fluid and different phases of fluid as statics, kinematics and dynamics, types of flows and the effect of flow through a pipe and flow over bodies.

Prerequisite: FYT102 Applied Physics, FYT105 Elements of Mechanical Engineering.

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Explain** [2] properties of fluids and concept of buoyancy.
CO2 :	**Solve** [3] the numerical assignments on kinematics and dynamics of fluid flow and momentum equation.
CO3 :	**Solve** [3] the numerical assignments on laminar flow of fluids.
CO4 :	**Apply** [3] the concept of boundary layer to workout exercises on lift and drag.
CO5 :	**Apply** [3] Dimensional analysis theorem to different fluid flow models.
CO6:	**Illustrate** [3] the thermodynamic relationships of perfect gases for one-dimensional flow.

Unit No.	**Contents**	Lecture Hrs
Unit 01	**Basics:** Introduction, Properties of fluids, Concept of continuum, types of fluids, pressure at a point in the static mass of fluid, variation of pressure, Pascal's law, types of pressure and pressure measuring devices. **Fluid Statics:** Total pressure and center of pressure for horizontal plane, vertical plane surface and inclined plane, surface submerged in static fluid. Buoyancy, center of buoyancy, meta center and meta centric height, its application in shipping, stability of floating bodies.	**07**

Unit 02	**Fluid Kinematics**: Types of Flow, stream lines, path lines, streak lines, velocity components, convective and local acceleration, velocity potential and stream function, continuity equation in Cartesian co-ordinates. Rotation, vorticity and circulation, Problems. **Fluid Dynamics:** Momentum equation, Impacts of jets- force on fixed and moving vanes, flat and curved. Numerical. Euler's equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem, venturi meter, orifice meter, pitot tube, Rectangular and triangular notch, orifices etc., related numerical.	**09**
Unit 03	**Laminar and Turbulent Flow**: Reynods Number, Entrance flow and Developed flow,Navier-Stokes Equation (without derivation), Laminar flow between parallel plates, Poiseuille equation – velocity profile, Couette flow, Fully developed laminar flow in circular pipes, Hagen - Poiseuille equation, related numerical. Loss of Pressure Head due to Fluid Friction, Darcy-Weishach formula, major and minor losses in pipes, Commercial pipe, Colebrook equation, Moody equation/ diagram. Pipes in series, parallel, equivalent pipe, Related Numerical.	**08**
Unit 04	**Flow Over Bodies:** Development of boundary layer, Prandtl's boundary layer equations, Blasius solution, laminar layer over a flat plate, boundary layer separation and its control. Basic concept of Lift and Drag, Types of drag, Co-efficient of drag and lift, streamline body and bluff body, flow around circular bodies and airfoils, Lift and drag on airfoil, Numerical.	**05**
Unit 05	**Dimensional Analysis:** Need for dimensional analysis, Dimensions and units, Dimensional Homogeneity and dimensionless ratios, methods of dimensional analysis, Rayleigh's method, Buckingham Pi theorem, Similitude and Model studies. Numerical.	**06**
Unit 06	**Compressible Flows:** Introduction, thermodynamic relations of perfect gases, speed of sound, pressure field due to a moving source, basic equations for one-dimensional flow, stagnation and sonic Properties, normal and oblique shocks.	**05**

MET08: Fluid Mechanics

Sr. No.	Text Books
01	Fluid Mechanics (SI Units), Yunus A. Cengel John M. Cimbala, 3/e., Tata McGraw Hill, 2014.
02	Fluid Mechanics, F M White, McGraw Hill Publications, 8/e. 2016.

Sr. No.	Reference Books
01	Fluid Mechanics, John F. Douglas, Janul and M. Gasiosek and John A. Swaffield, Pearson Education Asia, 5/e., 2006.
02	Fluid Mechanics and Hydraulic Machines, Dr. R.K. Bansal, Laxmi Publications, 2016.
03	Fluid Mechanics and Hydraulic Machines, Dr. R.K. Rajput, S. Chand Publications, 2015.
04	Fluid Mechanics and Hydraulic Machines, Dr. D. S. Kumar, S.K Kataria and Sons Publications, 2015.

MET10: Metrology

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Metrology	2	-	-	2	L(100)	FET	100	Min 40
						CAT-I	15	
						CAT-II	15	
						ESE	50	

Course Contents:

Quality assurance of the parts manufactured is essential for customer satisfaction and company survival. In this context, this course deals with the basic principles of dimensional measuring instruments and precision measurement techniques. It consists of measurement of linear and angular dimensions, surface characteristics and geometrical relationships between features of components. It also contains analysis of the measured inspection data for the purpose of maintaining quality.

Course Prerequisite: Applied Physics FYT 102

Course Co-requisites: Machine Drawing MET12

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Explain** [2] the concept of limits, fits and tolerances used in components and assemblies.
CO2 :	**Explain** [2] working principles of measuring instruments, for linear and angular dimensions and comparative measurements.
CO3 :	**Interpret** [2] measured data of straightness, flatness and surface roughness of samples.
CO4 :	**Illustrate** [2] instruments for measurement of various parameters of thread and gears.
CO5 :	**Illustrate** [2] linear and angular digital measuring instruments for measurement of mechanical elements and assemblies
CO6:	**Construct** [3] control charts using measured inspection data for drawing inferences.

Unit No.	**Contents**	Lecture Hrs
Unit 01	**Linear Measurements, Tolerances and Gauging**	05
	Need of measurement, line and end measurement, errors in measurement, Vernier caliper, vernier height gauge, vernier depth gauge, micrometers;Limits, fits and tolerances, IS specifications of limits, unilateral and bilateral tolerances, Types of Fits, Slip gauges, Design of plug and ring gauges.	
Unit 02	**Comparators and Angle Measurement**	05
	A) Comparators: Principle and characteristics of Mechanical,	

	Optical, Electrical, Pneumatic comparators;Applications of Mechanical and pneumatic comparators in manufacturing B) Angle Measurement: Bevel Protractor, Spirit level, Angle gauges, Sine bar, Angle Dekkor, Use of standard balls and rollers for angle measurement	
Unit 03	**Measurement of Straightness, Flatness and Surface Roughness**	04
	Concept of straightness and flatness, Measurement of Straightness, Principle of interferometry and its application for checking flatness. Surface roughness terminology, Direction of lay, textures, symbols, CLA, R_a,RMS,R_z&R_t values and their interpretation, Surface roughness measurement.	
Unit 04	**Measurement of Screw Threads and Gears**	05
	A) Errors in screw threads, Measurement of forms of thread with profile projector, Pitch measurement, Measurement of thread diameters with standard wire, screw thread micrometer. B) Errors in gears, Measurement of Spur Gears, Run out checking, Pitch measurement, Profile checking, Backlash checking, Tooth thickness measurement, Alignment checking, Checking of composite errors	
Unit 05	**Digital Measurement**	04
	In-process gauging, Machine vision, Digital instruments for measurement,Co-ordinate measuring machine (CMM) - construction, types, operation, Type of inspection probes, Use of CNC machines for coordinate measurement	
Unit 06	**Statistical Quality Control**	05
	Statistical methods in quality control, Six sigma quality concept Different types of control charts (Xbar, R, p, np and c charts), their interpretations and applications,	

Sr. No.	**Text Books**
01	"Engineering Metrology",I.C. Gupta, DhanpatRai Publications.
02	"Engineering Metrology", R.K.Jain, Khanna Publisher
03	"Mechanical Measurement", Beckwith and Buck, Pearson Education Asia,5th Edition,2001.
04	"Mechanical Measurement and Control" D.S. Kumar, Metropolitan Book Co.Pvt.Ltd.,New Delhi,4th Edition,2007.

Sr. No.	**Reference Books**
01	"Practical Engineering Metrology",Sharp K.W.B. Pitman, London
02	"Mechanical Measurement and Control", A.K. Sawhney and P. Sawhney, DhanpatRai and Company Pvt.Ltd.,New Delhi, 12th Edition,2010

MET12: Machine Drawing & CAD Lab

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Machine Drawing & CAD Lab	-	-	4	2	P(100)	FEP	100	Min 40

Course Contents: This course provides the knowledge and skills of preparing engineering drawings of different machine parts, sub-assemblies and assemblies required for process planning, manufacturing, tool design, designing special purpose machines etc. It includes application of tolerances and fits for assembled products. This is achieved through development of surfaces, Representation of elements of machine drawing, Component Drawings and Assembly drawings. Both manual exercises and drawing using solid modeling CAD software

Prerequisite: Engineering Graphics: FYT 109 and FYT 111

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Explain** [1] the different symbols and nomenclature used in machine drawings.
CO2 :	**Apply** [3] the drawing techniques for development of surfaces of sheet metal components manually and using CAD software.
CO3 :	**Apply** [3] the drawing techniques to draw the different machine elements, single and joined, manually and using CAD software.
CO4 :	**Illustrate** [3] an assembly drawing drawn using part drawings of machine components, manually and using CAD software.
CO5 :	**Demonstrate** [2] representations of tolerances and surface roughness, manually and using CAD software.

*(**Note**: Technical Graphics is used to communicate the necessary technical information required for manufacture and assembly of machine components. These drawings follow rules laid down in national and International Organizations for Standards (ISO).*
Hence the knowledge of the different standards is very essential. Students have to be familiar with industrial drafting practices and thorough understanding of production drawings to make them fit for industries.)

Sr. No.	Practical Contents	Proposed Work	No. of Practical Sessions (2 Hrs)
01	**Introduction** Need of Graphical Language, Importance Machine Drawing, Tools (from Instruments to Current Software) **Projections** Designation, Relative position of views, Examples **Classification of Machine Drawings** Assembly Drawing, Part Drawing, Detailed Drawing,	Lectures	**01**

Sr. No.	Practical Contents	Proposed Work	No. of Practical Sessions (2 Hrs)
	Catalogues Drawing, Drawing for Instruction Manuals, Schematic Representation, Patent Drawing **Principles of Drawings** Scales as per ISO standards, eg. A3 x 3 (420 x891), Importance of Title Block and Part list Lines types (Lines used in Machine Drawings) **Reproduction of Drawings** Blue printing, Ammonia Printing, Xeroxing, Printing, Plotting		
02	**Sectioning** Cutting Planes and Section, Hatching Lines, Half Sections, Aligned Sections, Offset Sections, Revolved, Removed Sections, Local Sections, Successive Sections, Thin Sections **Dimensions** Principle of Dimensioning, Counter Sink, Counter Bores, Spot Faces, Chamfers, Screw Threads, Tapered Features, **Limits, Fits and Tolerance** Definitions, Classifications of Fits, System of Fits, Computations, Selection of Fits, Method of Indicating Fits on Drawings, Tolerance Grade, Computations of Tolerance, Positions of Tolerance, Fundamental of Deviations, Shaft and Hole Terminology, Method of Placing Limit Dimensions, Need of Geometrical Tolerance, Geometrical Characteristics of Symbols, Indication of MMC, Interpretation of Indication of Geometrical Tolerance **Conventional Representations** Common features, Springs, Gear Assemblies, Materials, Interrupted views and Braking of Shaft, Pipe, Bar, Surface finishing & Machining Symbols, Abbreviations and Symbols	Lectures & Drawing Sheet 01 (Types of Lines, Sections, Dimensioning, Shaft-Hole System for Limits & Fits, Conventional Representations)	**02**
03	**Screwed Fastenings** Screwed Fastenings, Screw Thread Nomenclature, Threads Form, Form of V Threads, Form of Square Threads, Conventional representations, Types of Bolts, Designation, Types of Nuts, Types of Screw, Designation of Bolted Joints, Stud Joints, Types of Nut Locking Arrangements, Special Types of Bolts and Nuts.	Lectures & Drawing Sheet 02 (Free Hand Sketching of Fasteners)	01
04	**Symbols and its conventions** **Key Joints** Types of Key joints, Type of Cotter Joints, Types of Pin	Lectures & Drawing Sheet 03	01

Sr. No.	Practical Contents	Proposed Work	No. of Practical Sessions (2 Hrs)
	Joints and knuckle Joints **Riveted Joints** Introduction Rivet and Riveting, Classification of Rivet, Terminology of Riveted Joint Types of Joints **Welded Joints** Introduction of Welding Process, Types of Welded Joints, Representation of Welds **Pipes and Pipe Joints** General discussions, Types of Pipe Joints, Piping Layout and Conventions **Pulleys** Applications of Pulleys, Types of Pulleys **Couplings** Applications of Couplings, Types of Couplings, Working Principles	(Free Hand Sketching of Keys, Riveted, Welded, Pipe Joints, Pulleys & Coupling)	
05	**Assembly Drawings** Introduction, Types of Assembly, Importance of BOM, Assembly procedures, Assembly of Engine Parts, Assembly of Machine Tools Parts	Lectures & Drawing Sheet 04 (Assembly Drawing)	02
06	**Production Drawings** Definitions, Difference with Normal Drawings, Method of amendment of Corrections, representing conventional representations and symbols for machining, dimensioning, etc.	Lectures & Drawing Sheet 05 (Detailed Drawing)	01
07	**Computer Aided Modeling & Drafting** Part Modeling, Assembly Modeling, and Drafting using any advanced CAD Software	CAD Model & Drawing Sheet through CAD	
	Part Modeling of minimum 08 components. The part modeling should be representing conventional representations and symbols for machining, dimensioning, etc.	Print 01 : Drafting of Part Models in standard views Print 02 : Solid view of Parts	04
	Assembly Modeling comprised of minimum 8 components. The assembly modeling should be representing conventional representations and symbols for machining, dimensioning, etc. Drafting of Part Models in standard view & Solid view.	Print 03 : Drafting of Assembly Model in standard views Print 04 : Solid view of Assembly	04

MET12: Machine Drawing & CAD Lab

Sr. No.	Text Books
01	P.S. Gill, Machine Drawing., S.K. Kataria and Sons , Delhi, 7th Edition,2008
02	N. D. Bhatt,. Machine Drawing. Charotor Publication House, Bombay, 42th Edition , 2007
03	CAD/CAM- Principals and Applications, P.N. Rao, McGraw Hill

Sr. No.	Text Books
01	N. Sidheshwar . P. Kannaiah and V.V. S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi.
02	S. K HajraChoudhury, Elements of workshop technology – Vol. II,, Media Promoters And Publishers, Mumbai
03	R.K. Dhavan, Machine Drawing, S. Chand and Company, 1st Edition, 1996.
04	“Production Drawing”, Narayana, Kannaiah and VenkataReddv,New Age International.2nd Edition, 2002.
05	“Machine Drawing”, N.D.Junnarkar,Print Pearson Education, 1st Edition.

MET14: Workshop Practice IV (Basic CNC)

Course	L	T	P	C	Evaluation Scheme			
					Component	Exam	WT	Pass
Workshop Practice IV (Basic CNC)	-	-	2	1	P(100)	FEP	50	Min 40
						ESE	50	

Course Contents: This course contains hands on working on machines like CNC lathe simple components. It familiarizes the student with CNC machine accessories , manual part programming for CNC machines and assembly practices and the concepts of fits.

Course Prerequisite: Workshop Practice I, II and II: FYT 120, FYT126 and MET13.

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Build** [3] assembly comprising of 4-5 machined parts.
CO2 :	**Explain** [3] features of CNC machines and working principles.
CO3 :	**Explain** [3] accessories and tools of CNC machines and their uses.
CO4 :	**Make use of** [3] CNC part programming techniques to develop and execute a part program for a simple component on CNC lathe.

Sr.No.	**Term Work**
01	Fabrication of one assembly comprising of minimum four parts produced on lathe, drilling and milling machines in the workshop
02	Study of construction and working of CNC lathe and machining centers (VMC/HMC), Turn-Mill Centers
03	Study of CNC axes & drives, Automatic Tool Changer (ATC) and Automatic pallet changer (APC), Applications
04	Study and Demonstration of tools used in CNC machines, Tool Presetting
05	Manual part programming exercise using G and M codes for Turning, Facing, Step turning, Taper turning, profile turning,; Two simple exercises of programming and machining on CNC Lathe in a group of maximum four students, (Each group shall make different parts).
06	Industrial visit to study operations of Vertical Machining center, Horizontal Machining center and Turn-mill Centers.

Sr. No.	**Text Books**
01	CAD/CAM- Principals and Applications, P.N. Rao, McGraw Hill
02	S. K HajraChoudhury, Elements of workshop technology – Vol. II,, Media Promoters And Publishers, Mumbai

Sr. No.	**Reference Books**
01	Chennakesava R. Alavala – CAD/CAM – Concepts and Applications – PHI
02	Fundamentals of Tool Design-ASTME Publication.

MET16: Computer Programming Lab

Course	L	T	P	C	Evaluation Scheme			
					Component	Exam	WT	Pass
Computer Programming Lab	-	-	2	1	P(100)	FEP	50	Min 40
						ESE	50	

Course Contents: With computerization of every system in engineering, basic programming abilities are essential for engineers. This course imparts the skills in programming using C++ and introductory programming using MATLAB. It deals with the features of these programming languages and their application for handling different computational tasks.

Course Prerequisites: Computer Programming FYT 119

Course Co-requisites: ---

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Make use of** [3] of C++ operators, loop control statements for writing and executing simple programs.
CO2 :	**Develop** [3] programs for execution with C++ for processing arrays and arrays with pointer.
CO3 :	**Make use of** [3] structures and class for writing and executing simple programs in C++.
CO4 :	**Make use of** [3] class and objects for writing and executing simple programs in C++.
CO5 :	**Develop** [3] simple executable programs with MATLAB.
CO6:	**Develop** [3] executable programs of conditional program flow (if), iteration / Looping.

Unit No.	**Term Work**	Practical Hrs
01	Assignment on programs of operators, loop control statements	02
02	Assignment on programs of Array, Array with pointer	04
03	Assignment on programs of Structure, Class and Objects-i	04
04	Assignment on programs of Structure, Class and Objects-ii	04
05	Assignments on simple programs using MATLAB software (Minimum two)	04
06	Assignment on programs of Conditional program flow (if), Iteration / Looping	02

MET16: Computer Programming Lab

Sr. No.	Text Books
01	Object Oriented Programming by E. Balguruswami
02	Object-Oriented Programming in C++ by Rajesh K Shukla
03	MATLAB and its application in Engineering by Rajkumar Bhansal

Sr. No.	Reference Books
01	"The C++ Programming Language" by Bjarne Stroustrup
02	"The C++ Standard Library: A Tutorial and Reference" by Nicolai M Josuttis
03	A Guide to MATLAB: For Beginners and Experienced Users by Brian R. Hunt

MET18 : Electrical Technology & Electronics Lab

Course	L	T	P	C	Evaluation Scheme			
					Component	Exam	WT	Pass
Electrical Technology & Electronics Lab	-	-	2	1	P(100)	FEP	100	Min 40

Course Code:	Course Name	Nature
MET18:	**Electrical Technology & Electronics Lab**	**Lab**

Course Contents: This course provides with hands-on working on electrical motors, drives and control. It also familiarizes the student with the basic sensors, multiplexers and LAN technology used in electronic control of machines and devices.

Course Prerequisites: FYT 118 Elements of Electrical Engineering Lab, FYT 117 Elements of Electronics Engineering Lab

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Explain** [2]speed control methods of DC motor.
CO2 :	**Make use of**[2] testing setups to carry out load tests on DC shunt motor and three phase induction motor.
CO3 :	**Illustrate** [2] DC/AC motor starters.
CO6 :	**Identify** [3]various displacement and temperature transducers.
CO7 :	**Demonstrate** [3] operation of encoders, decoders, multiplexers, multiplexers and flip flops using digital ICs.
CO8:	**Relate** [2]the applications to Internet of Things domain.
CO9:	**Explain** [2] the process of LAN set up.

Sr. No.	Minimum four experiments from sr. no. 1. To 5.and five experiments from sr. no. 6 to 11, from the following list should be performed, and report to be submitted in prescribed format
01	Speed control of d.c. shunt motor by flux control method.
02	Speed control of d.c. shunt motor by armature voltage control.
03	Load test on d.c. shunt motor.

04	Load test on 3 phase induction motor.
05	Study of DC/AC motor starters
06	Study of Displacement andTemperature Transducers
07	Study of Encoders and decoders
08	Study of multiplexers and demultiplexers
09	Study of flip-flops
10	Practical exercises on Basics of Internet of Things
11	Study of LAN set up

MET20: Kinematics of Machines Lab

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Kinematics of Machines Lab	-	-	2	1	P(100)	FEP	100	Min 40

Course Contents:

This lab course familiarizes the students with the techniques of analyzing mechanisms using different equipment.

Course Prerequisite: FYT 108 Engineering Mechanics, MET09 Strength of Materials

Course Co-requisites: MET 09 Kinematics of Machines

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Construct** [3] velocity, acceleration diagrams and cam profiles for given applications.
CO2 :	**Experimentwith** [3] Porter or Hartnell governor to find out their characteristics.
CO3 :	**Experimentwith** [3] belt and dynamometers to find out their characteristics.
CO4 :	**Make us of** [3] software for analysis of simple mechanisms.

Sr. No.	Any 10 experiments to be performed and report to be submitted in prescribed format.
01	Study of basic mechanisms. (Demonstration of models, Actual mechanisms, etc.)
02	One A3 size drawing sheet of Velocity problems by relative velocity method. (Minimum 4 problems)
03	One A3 size drawing sheet of Velocity problems by Kliens construction and Instantaneous center method. (Minimum 4 problems)
04	One A3 size drawing sheet of Acceleration problems by relative acceleration method. (Minimum 4 problems)
05	Verification of ratio of angular velocities of shafts connected by Hooks joint.
06	One A3 size drawing sheet of Problems on cam profile. (Minimum 4 problems)
07	Experiment on Governor characteristics for Porter or Hartnell governor.

08	Experiment on Cam Profile
09	Experiment on belt drives.
10	Experiment on Dynamometer
11	Computer aided analysis of simple mechanisms.

MET22 : Fluid Mechanics Lab

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Fluid Mechanics Lab	-	-	2	1	P(100)	FEP	100	Min 40

Course Contents:

This course deals with use of different measuring instruments for linear, angular geometrical dimensions, both absolute and comparative. Further it includes measurement of screw threads and gears and surface characteristics. The measurement lab includes measurement of mechanical quantities such as, speed, temperature, pressure, flow, vacuum, displacement, force, torque, vibrations with the help of mechanical measuring instruments.

Course Prerequisite: Applied Physics FYT 102, Elements of Electrical Engg. FYT 107

Course Co-requisite: Metrology MET 10

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Select**[3] conventional and digital instruments for measurement of different parameters of given samples of components.
CO2 :	**Make use of** [3] instruments for measurement of various parameters of thread and gears.
CO3 :	**Analyse**[4] collected measurement data using control charts.
CO4 :	**Explain**[2] various types of static characteristics of measuring instruments.
CO5 :	**Make use of** [3] instruments for measurement of various mechanical quantities.
CO6 :	**Interpret**[2] the measured values of mechanical quantities.

Sr. No.	Experiments to be performed and report to be submitted in prescribed format.
01	Study of manometers and the demonstration of the same.
02	Determination of metacentric height of a floating body.
03	Flow pattern development using Heleshaw's apparatus.
04	Calibration of venture-meter and orifice meter.
05	Verification of Bernoulli's Theorem.

06	Calibration of V-notch or rectangular notch.
07	Study of minor losses in the flow system.
08	Determination of co efficient of friction in pipes for different materials.
09	Determination of loss of friction in series/parallel pipes.
10	Reynolds experiment.

MET24: Metrology & Mechanical Measurements Lab (*Two labs*)

Course	L	T	P	C	Evaluation Scheme			
					Component	**Exam**	**WT**	**Pass**
Metrology & Mechanical Measurements Lab	-	-	4	2	P(100)	FEP	50	Min 40
						ESE	50	

Course Contents:

This course deals with use of different measuring instruments for linear, angular geometrical dimensions, both absolute and comparative. Further it includes measurement of screw threads and gears and surface characteristics. The measurement lab includes measurement of mechanical quantities such as, speed, temperature, pressure, flow, vacuum, displacement, force, torque, vibrations with the help of mechanical measuring instruments.

Course Prerequisite: Applied Physics FYT 102, Elements of Electrical Engg. FYT 107

Course Co-requisite: Metrology MET 10

Course Outcomes: After the completion of this course, the student will able to,

CO1 :	**Select**[3] conventional and digital instruments for measurement of different parameters of given samples of components.
CO2 :	**Make use of** [3] instruments for measurement of various parameters of thread and gears.
CO3 :	**Analyse**[4] collected measurement data using control charts.
CO4 :	**Explain**[2] various types of static characteristics of measuring instruments.
CO5 :	**Make use of** [3] instruments for measurement of various mechanical quantities.
CO6 :	**Interpret**[2] the measured values of mechanical quantities.

Sr. No.	**Lab 1- Metrology**: (2 Hrs/week) Experiments to be performed and report to be submitted in prescribed format.
01	Measurement of part dimensions using Vernier caliper, Height vernier, Depth vernier and report preparation
02	Measurement of part dimensions using outside micrometers, Depth micrometer, Flange type micrometer and report preparation
03	Design of plug and snap gauge for given toleranced dimensions
04	Use of Comparators, bore dial gauge for dimensional measurements, Study and Use of Angle Measuring Instruments for angle measurement; and report

	preparation
05	Measurement of Screw Threads and Gear Measurement and report preparation
06	Calculations of average and standard deviation for a given dimension from a set of 25 to 50 samples of measured data values and plotting Normal Distribution Curve
07	Plotting Control Chart (any one) for a set of measured values for a dimension and their interpretation
08	Exercise on Six Sigma Quality concept

Sr. No.	**Lab 2- Mechanical Measurements**: (2 Hrs/week) Experiments to be performed and report to be submitted in prescribed format.
	(Basic theory for each experiment shall be discussed before performing the experiment.)
01	Introduction to Measurement (Theory Assignment)
02	Angular speed measurement using Stroboscope, Photo-electric pick up and magnetic pick up.
03	i) Formation of Thermocouple tip and Calibration of Thermocouple ii) Measurement of temperature using Thermocouple, RTD and Thermistors.
04	i) Testing of Mechanical pressure gauge using Dead weight pressure gauge tester. ii) Vacuum measurement using Mc-Lead gauge and Pirani gauge.
05	Measurement of displacement using LVDT
06	Flow measurement using Rotameter, Turbine meter, Anemometer and Target meters
07	Force and torque measurement using strain gauges and load cell
08	Vibration testing using contact and non-contact type instruments Introduction to FFT Analyzer

Sr. No.	**Reference Books**
01	“Practical Engineering Metrology”, Sharp K.W.B. Pitman, London
02	“Mechanical Measurement and Control”, A.K. Sawhney and P. Sawhney, Dhanpat Rai and Company Pvt. Ltd., New Delhi, 12th Edition,2010

MET224: Professional Development – II

(Ver 1.0,)

For Sem.-IV of B. Tech (Common for All Branches)

Course Description: This course is the extension of the Professional Development – I course of third semester. The course aims to develop leadership skills and sharpen their decision making skills. The major focus of the course is to prepare students for job.

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

CO01 : demonstrate[3] leadership skills

CO02 : evaluate[6] process and practical ways of decision making

CO03 : judge[6] causes of stress and find remedies to reduce stress

CO04 : apply[3] business etiquettes and ethics

CO05 : exhibit[3] group discussion and Interview skills

Syllabus

Units	Description	Hrs.
I	**Leadership:** Skills for a good Leader, Assessment of Leadership Skills **Creativity:** Lateral thinking, vertical thinking, Out of box thinking	4
II	**Decision Making:** Importance and necessity of Decision Making, Process and practical way of Decision Making, Weighing Positives & Negatives.	4
III	**Stress Management**: Causes of Stress and its impact, how to manage & distress, Circle of control, Stress Busters. **Emotional Intelligence**: What is Emotional Intelligence, dealing with feelings, emotional quotient, why Emotional Intelligence matters, Emotion Scales. Managing Emotions.	4
IV	**Adapting to corporate life**: Corporate Grooming and dressing, Business Etiquette Business Ethics, Dinning Etiquette, Ethics policy	4
V	**Group Discussion:** Group discussions as part of selection process. Structure of a group discussion, Dynamics of group behavior, techniques for effective participation, Team work and use of body language. **Interview:** Process, techniques, Pre-In-After the interview preparation.	4

MET224: Professional Development – II

References:

1. Wallace & Masters, Personal development for Life & work, Thomson Learning.

2. Barun K. Mitra , Personality Development and Soft- Skills , Oxford University Press.

3. Fred Luthans, Organizational behavior, McGraw Hill.

4. Asa Don Brown, Interpersonal skills in the Workplace, Tate publishing and Enterprises.
