CMR Institute of Technology, Bangalore		
Department: CSE,MECHANICAL		
Semester: 04		
Engineering Mathematics IV	15MAT41	Lectures/week: 06
Course Instructor: UMA RAJU		
Course duration:		

Class	Chapter Title	Topic	Percentage of portion covered	
			Individual	Cumulative
01-06	**Module I**	**Numerical Methods**: Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae).	20	20
07-11	**Module II**	**Numerical Methods**: Numerical solution of second order ordinary differential equations : Runge-Kutta method and Milne's method.	10	30
12-30	**Module III**	**Complex Variables:** Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems. **Transformations:** Conformal transformations, discussion of transformations: $w= z^2$, $w=e^z$, $w = z + (1/ z)(z \neq 0)$ and bilinear transformations-problems.	20	50
31-44	**ModuleIV**	**Probability Distributions:** Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems. **Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.	20	70
45-58	**Module V**	**Stochastic process:** Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability,	20	90

		simple problems. **Sampling Theory:** Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.		
59-66	**Module II**	**Special Functions:** Series solution-Frobenius method. Series solution of Bessel's differential equation leading to $J_n(x)$-Bessel's function of first kind. Basic properties, recurrence relations and orthogonality. Series solution of Legendre's differential equation leading to $P_n(x)$-Legendre polynomials. Rodrigue's formula, problems.	**10**	**100**

Sessional	**Syllabus**
T1	Class 01-31
T2	Class 32-56
T3	Class 57-64

Literature:

Book Type	**Code**	**Author & Title**	**Publication information**	
			Edition & Publisher	**ISBN**
Text Book	TB1	B.S. Grewal, Higher Engineering Mathematics, Latest Edition, Khanna publishers	Latest edition, Khanna publications	8174091955
Text Book	TB2	Erwin Kreyszig, Advanced Engineering Mathematics	Latest Edition Wiley India publishers	978812653135
References	RB1	B.V Ramana, Higher Engineering Mathematics,.	Latest Edition, Tata Mc. Graw Hill Publications	---
References	RB2	Peter V . O'Neil, Engineering Mathematics.	Cengage Learning India Pvt. Ltd. Publishers	---
References	RB3	Dr. D.S.C , Engineering Mathematics IV		
References	RB4	Dr. K.S.C , Engineering Mathematics IV		

CMR Institute of Technology, Bangalore		
Department: Mechanical Engineering		
Semester: 04	Section(s): A & B	
Kinematics of Machines	15ME42	Lectures/week: 06
Course Instructor(s): Mrs. Smruti Rekha Swain		
Course duration: 13th Feb 2017 – 24th May 2017		

Lesson Plan

# Class	Chapter Title/ Reference Literature	Topic Covered	Percentage of portion covered	
			Reference	Cumulative
1-10	**MODULE – 1** **TB1**:1.1 to 1.17, 1.16 to 1.17, 6.1 to 6.2, 6.5 **TB2**: 1.1 to 1.12, 3.2 to 3.4, 3.7.2	**Introduction:** Definitions – link, kinematic pairs, kinematic chain, mechanism, structure, degrees of freedom, Classification links, Classification of pairs based on type of relative motion, Grubler's criterion, mobility of mechanism, Groshoff's criteria, inversions of Grashoff's chain. **Mechanisms:** Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Oldham's coupling **Straight line motion mechanisms**: Peaucellier's mechanism and Robert's mechanism. **Intermittent Motion mechanisms:** Geneva wheel mechanism, Ratchet and Pawl mechanism, toggle mechanism, pantograph, condition for Correct steering, Ackerman steering gear mechanism.	20%	20%
11-30	**MODULE – 4** **TB1**: 7.1 to 7.10, 10.1 to 10.26, 11.1 to 11.2 **TB2**: 7.1 to 7.14, 11.1 to 11.22, 12.1 to 12.7	**Cams:** Types of cams, types of followers. Displacement, velocity and acceleration curves for uniform velocity, Simple Harmonic Motion, Uniform Acceleration Retardation, Cycloidal motion. **Cam profiles:** disc cam with reciprocating / oscillating follower having knife-edge, roller and flat-face follower inline and offset. **Analysis of Cams:** Analysis of arc cam with flat faced follower. **Spur Gears:** Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. Interference in involute gears, methods of avoiding interference, back lash, condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact. **Gear Trains:** Simple gear trains, compound gear trains. **Epicyclic gear trains:** Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, torque calculation in epicyclic gear trains.	40%	60%
31-40	**MODULE – 2** **TB1**: 2.1 to 2.10, 2.12 to 2.16, 3.1 to 3.6, 3.8 **TB2**: 2.1 to 2.6, 2.8	**Velocity and Acceleration Analysis of Mechanisms (Graphical Method):** Velocity and acceleration analysis of four bar mechanism, slider crank mechanism. Mechanism illustrating, Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing. **Velocity Analysis by Instantaneous Center Method:** Definition, Kennedy's theorem, Determination of linear and angular velocity using instantaneous center method. **Klein's Construction:** Analysis of velocity and acceleration of single slider crank mechanism.	20%	80%

41-50	**MODULE – 3** **TB1**: 2.11, 3.7 **TB2**: 2.9	**Velocity and Acceleration Analysis of Mechanisms (Analytical Method):** Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra method. Freudenstein's equation for four bar mechanism and slider crank mechanism. Function Generation for four bar mechanism.	20%	100%

Syllabus for Internal Assessment Tests (IAT)*

Sessional #	Classes	Syllabus
T1	1 – 18	33%
T2	19 – 32	30%
T3	33 – 52	37%

* See calendar of events for the schedules of IATs.

LITERATURE:

Book Type	Code	Author and Title	Publication Information	
			Edition & Publisher	ISBN #
Text Book	TB1	"Theory of Machines",Rattan S.S	3rd Edition 2009, Tata McGraw Hill Publishing Company, New Delhi	978-0-07-014477-4
Text Book	TB2	"Theory of Machines", Sadhu Singh	2nd Edition 2006, Pearson Education(singapore)	978-81-7758-127-0
Reference book	RB1	"Theory of Machines", Thomas Bevan	3rd Edition 2011, Pearson Education Ltd, UK.	978-81-317-2965-6
Reference book	RB2	"Theory of Machines & Mechanisms", John J Uicker JR. Gordon R. Pennock, Joseph E. Shingley	3rd Edition 2009, Oxford University Press, UK.	0-19-806232-X

CMR Institute of Technology, Bangalore			
Department(s): department of Mechanical Engineering			
Semester: 06	Section(s):		
Applied Thermodynamics		10ME43	Lectures/week: 06
Course Instructor(s): Narendra N			
Course duration: 18 Jan 2017 – 21 May 2017			

Class #	Chapter Title / Reference Literature	Topic	Percentage of portion covered	
			Reference	Cumulative
1-11	TB1: 3.1 to 3.14	**Gas Power Cycles** :Air standard cycles; Carnot, Otto, Diesel, Dual and Stirling cycles, p-v and T -s diagrams, description, efficiencies and mean effective pressures. Comparison of Otto and Diesel cycles. **Gas turbine (Brayton) cycle**; description and analysis. Regenerative gas turbine cycle. Inter-cooling and reheating in gas turbine cycles. 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 engines.	13.5%	13.5 %
11-22	TB1: 4.1 to 4.15	Vapour Power Cycles: Carnotvapour power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T-s diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapourpower cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water heaters. Reheat Rankine cycle. Characteristics of an Ideal working fluid in Vapour power cycles, Binary Vapour cycles	13.5 %	27 %
23-28	TB1: 2.1 to 2.14	**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. Dissociation and equilibrium, emissions. **I.C.Engines:** Classification of IC engines, Combustion of SI engine and CI engine, Detonation and factors affecting detonation, Performance analysis of I.C Engines, heat balance, Morse test, IC Engine fuels, Ratings and Alternate Fuels. Automotive Pollutions and its effects on environment.	11.5%	38.5%
28-40	TB2: 7.1 to 7.9	**Refrigeration:** Vapour compression refrigeration system Refrigerating effect, capacity, Power required units of Refrigeration. Refrigerants and their desirable properties reversed Carnot cycle reversed Brayton cycle. Vapour absorption Refrigeration system, Steam jet Refrigeration Numerical problems **Psychometry:** Atmospheric air and psychometric properties; Dry bulb temperature, wet bulb	11.5%	50%

		temperature, dew point temperature Partial pressures, specific and relative humidity and the relation between the two enthalpy and adiabatic saturation temperature. Construction and use of psychometric chart. Analysis of various processes; heating, cooling, dehumidifying and humidifying. Adiabatic mixing of moist air Summer and winter air conditioning Numerical problems		
40-56	TB2: 8.1 to 8.8	Reciprocating Compressors: Operation of a single stage reciprocating compressors. Work input through p-v diagram and steady state steady flow analysis. Effect of Clearance and Volumetric efficiency. Adiabatic, Isothermal and Mechanical efficiencies. Multi-stage compressor, saving in work, Optimum intermediate pressure, Inter-cooling, Minimum work for compression. Steam nozzles: Flow of steam through nozzles, Shape of nozzles, effect of friction, Critical pressure ratio, Supersaturated flow.	11.5%	61.5%

Syllabus for Sessionals :

Sessional #	Syllabus
T1	Class # 01 – 17
T2	Class # 15 – 35
T3	Class # 27 – 50

Literature:

Book Type	Code	Author & Title	Publication info	
			Edition & Publisher	ISBN #
Text Book		**Basic and applied Thermodynamics**	P.K. Nag, 2nd Ed.,Tata McGraw Hill Pub.Co,2002	
Text Book		**Applied Thermodynamics**	Rajput, Laxmi Publication	
Text Book		**Applied Thermodynamics**	B.K. Venkanna, Swati B. Wadavadagi, PHI, New Delhi, 2010	
References		**Thermodynamics , An engineering approach**	Yunus, A. Cengel and Michael A.Boies, 6th Ed., Tata McGraw Hill pub. Co., 2002	
References		**Fundamental of Classical Thermodynamics,**	G.J. Van Wylen and R.E. Sontang Wiley eastern.	

CMR Institute of Technology, Bangalore			
Department: Mechanical Engineering			
Semester: 04	Section(s): A & B		
Subject: Fluid Mechanics		15ME44	Lectures/week: 06
Course Instructor(s): Mr. Joseph Sajan			
Course duration: Feb 2017 – May 2017			

LESSON PLAN

Class No.	Chapter Title / Reference Literature	Topic	Percentage of portion covered	
			Reference	Cumulative
1-9	**Module – 1** **TB1/TB2/TB3**	**Basics:** Introduction, Types of fluid, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation, Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers.	**11.11%**	**11.11%**
10-18	**Module – 1** TB1/TB2/TB3	**Fluid Statistics**: Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid. Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically.	**11.11%**	**22.22%**
19-26	**Module – 2** **TB1/TB2/TB3**	**Fluid Kinematics:**Types of Flow-steady, unsteady, uniform, non-uniform, laminar, turbulent, one,two and three dimensional, compressible, incompressible, rotational, irrotational, stram lines, path lines, streak lines, velocity components, convective and local acceleration, velocity potential, stream function, continuity equation in Cartesian co-ordinates. Rotation, vorticity and circulation, Laplace equation in velocity potential and Poisson equation in stream function, flow net, Problems.	**11.11%**	**33.33%**
27-36	**Module – 2** TB1/TB2/TB3	**Fluid Dynamics:** Momentum equation, Impacts of jets-force on fixed and moving vanes, flat and curved. Numericals. Euler's equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem, Application of Bernoulli's theorem such as venture meter, orifice meter, rectangular and triangular notch, pitot tube, orifices etc., related numericals..	**11.11%**	**44.44%**
37-45	**Module – 3** TB1/TB2/TB3	**Laminar and turbulent flow:**Reynods Number, Entrance flow and Developed flow,Navier-Stokes Equation (no derivation),Laminar flow between parallel plates, Poiseuille equation –velocity profile, Couette flow,Fully developed laminar flow in circular pipes, Hagen - Poiseuille equation,related numericals. Energy consideration in pipe flow, Loss of Pressure, Head due to Fluid Friction, DarcyWeishach formula, major and minor losses in pipes,Commercial pipe, Colebrook equation, Moody equation/ diagram. Pipes in series, parallel, equivalent pipe, Related Numericals and simple pipe design problems.	**11.11%**	**55.55%**
46-53	**Module – 4** TB1/TB2/TB3	**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,	**11.11%**	**66.66%**

		Numericals.		
54-58	**Module – 4** TB1/TB2/TB3	**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. Numericals.	**11.11%**	**77.77%**
59-65	**Module – 5** TB1/TB2/TB3	**Compressible Flows:** Introduction, thermodynamic relations of perfect gases, internal energy and enthalpy, speed of sound, pressure field due to a moving source, basic Equations for one-dimensional flow, stagnation and sonic Properties, normal and oblique shocks.	**11.11%**	**88.88%**
66-71	**Module – 5** TB1/TB2/TB3	**Introduction to CFD**: Necessity, limitations, philosophy behind CFD, applications	**11.12%**	**100%**

Literature:

Book Type	Code	Author & Title	Edition & Publisher
Text Book	TB1	**Fluid Mechanics**, Dr. Bansal,	R.K.Lakshmi Publications, 2004
Text Book	TB2	**Fluid Mechanics (SI Units),** Yunus A. Cengel John M. Cimbala	2nd Ed., Tata McGraw Hill, 2006
Text Book	TB3	**Fluid Mechanics and Fluid Power Engineering,** Kumar D.S	Kataria and Sons, 2004
Reference Book	RB1	**Fluid Mechanics,** John F Douglas, Janul and M. Gasiosek	5th edition 2006, Pearson Education Asia

CMR Institute of Technology, Bangalore			
Department: Mechanical Engineering			
Semester: 04	Section(s): A&B		
Subject: **MACHINE TOOLS & OPERATIONS**		15ME35B	Lectures/week: 05
Course Instructor(s): Mr. SAGAR M BALIGIDAD.			
Course duration: 13 FEB-2017 – 21 MAY-2017			

LESSON PLAN

Class No.	Chapter Title / Reference Literature	Topic	Percentage of portion covered	
			Reference	Cumulative
1-15	TB1: 1.1 to 1.18 TB2: 1.1 to 1.24	Introduction, Classification, construction and specifications of lathe, drilling machine, milling machine, boring machine, broaching machine, shaping machine, planing machine, grinding machine	20%	20%
16-24	FB1: 3.3 to 3.16 TB2: 2.1 to 2.24	Introduction, Types of motions in machining, turning and Boring, Shaping, Planing and Slotting, Thread cutting, Drilling and reaming, Milling, Broaching, Gear cutting and Grinding, Machining parameters and related quantities.	20%	40%
25-36	FB1: 2.8 to 2.13 TB2: 3.1 to 3.24	**Introduction**, desirable Properties and Characteristics of cutting tool materials, cutting tool geometry, cutting fluids and its applications, surface finish, effect of machining parameters on surface finish. **Machining equations for cutting operations**: Turning, Shaping, Planing, slab milling, cylindrical grinding and internal grinding, Numerical Problems	20%	60%
37-46	FB1: 8.6 to 8.10 TB2: 4.1 to 4.19	Introduction, Chip formation, Orthogonal cutting, Merchants model for orthogonal cutting, Oblique cutting, Mechanics of turning process, Mechanics of drilling process, Mechanics of milling process, Numerical problems.	20%	80%
47-52	FB1: 6.3 to 6.11 TB2: 5.1 to 5.16	**TOOL WEAR, TOOL LIFE:** Introduction, tool wear mechanism, tool wear equations, tool life equations, effect of process parameters on tool life, machinability, Numerical problems **ECONOMICS OF MACHNING PROCESSES**: Introduction, choice of feed, choice of cutting speed, tool life for minimum cost and minimum production time, machining at maximum efficiency, Numerical problems	20%	100%

Syllabus for Sessional:

Sessional No.	Syllabus
T1	Class No. 01 – 21
T2	Class No. 22 – 40
Improvement test	Class No. 41 - 52

Book Type	Code	Author and Title	Publication Information	
			Edition & Publisher	ISBN #
Text book	TB1	**"Fundamentals of metal cutting and Machine Tools"** B.L. Juneja, G.S. Sekhon and Nitin Seth	2nd Edition & New Age International Publishers	978-8122414677
Text book	TB2	**"Machine Tools & Operations"** Sagar M Baligidad	1st edition & Sun-Star Publication	978-93-85155-67-3
Reference book	RB1	**Fundamental of Machining and Machine Tools**, Geoffrey Boothroyd and Winston A	3rd Edition CRC Taylor& Francis	978-1-574446593
Reference book	RB2	**Metal cutting principles**, Milton C. Shaw	2nd Edition- Oxford University Press	978-0-195142068

SCHEME OF EXAMINATION:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

CMR Institute of Technology, Bangalore		
Department(s): Mechanical Engineering		
Semester: 04	Section(s): 4 A & B	
Mechanical Measurement and Metrology	15ME46B	Lectures/week: 05
Course Instructor(s): Puneeth Kumar N		
Course duration: 13 Feb. 2015 – 02 June 2017		

Class #	Chapter Title / Reference Literature	Topic	Percentage of portion covered	
			Reference	Cumulative
1-10	**MODULE-I** Introduction to Metrology TB1:1.1 to 1.12, TB2:3.1 to 3.7 RB1 & RB2 and Linear & Angular Measurements TB1:3.1 to 3.17, TB2:5.1 to 5.8 RB1 & RB2	**Introduction to Metrology:**Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End Bars (Numerical), standardization. **Linear Measurement and angular measurements:** Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112). Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and squareness.	20%	20 %

11-20	**MODULE-II** System of Limits, Fits, Tolerance and Gauging TB1:2.1 to 2.29, TB2:4.1 to 4.5 & 4.11 to 4.13, RB1 & RB2 Comparators TB1:3.1 to 3.17, TB2:5.1 to 5.8 RB1 & RB2	**System of Limits, Fits, Tolerance and Gauging:** Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances. Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials. **Comparators:** Functional requirements, classification, mechanical- Johnson Mikrokator, sigma comparators, dial indicator, electrical- principles, LVDT, Pneumatic- back pressure gauges, solex comparators and optical comparators- Zeiss ultra-optimeter.	20 %	40 %
21-30	**MODULE-III** Measurements and measurement systems TB1: 5.1 to 5.25, RB1 & RB2 Advances in metrology	**MODULE -3** **Measurement of screw thread and gear:** Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3- wire methods, best size wire. Screw thread gauges, Tool maker's microscope. Gear tooth terminology, tooth thickness measurement using constant chord method, addendum comparator method and base tangent method, measurement of pitch, concentricity, run out, and involutes profile. Gear roll tester for composite error. **Advances in metrology:** Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications. Basic concepts of Coordinate Measuring Machines-constructional features, applications.	20 %	60%

31-40	**MODULE-IV** **Measurement systems and basic concepts of measurement methods** **Measurements and measurement systems** **TB1: 5.1 to 5.25, RB1 & RB2** **Intermediate modifying** **and terminating devices** **TB1:6.1 to 6.16, TB2,** **RB1 & RB2**	**Measurement systems and basic concepts of measurement methods:** Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-time delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. **Intermediate modifying and terminating devices:** Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillograph.	20 %	80 %
41-50	**MODULE-V** Measurement of force, torque and pressure TB1:7.1 to 7.16, TB2:6.1 to 6.10 RB1 & RB2 Unit-VIII Measurement of strain and temperature TB1:8.1 to 8.31, TB2, RB1 & RB2	**Force, Torque and Pressure Measurement:** Direct methods and indirect method, force measuring inst. Torque measuring inst., Types of dynamometers, Absorption dynamometer, Prony brake and rope brake dynamometer, and power measuring instruments. Pressure measurement, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. **Measurement of strain and temperature:** Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. Temperature Compensation, Wheatstone bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells and torque sensors. Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer	20 %	100 %

Syllabus for Sessionals:

Sessional #	Syllabus
T1	Class # 01-20
T2	Class # 21-40
T3	Class # 41-50

Literature:

Book Type	Code	Author & Title	Publication info	
			Edition & Publisher	**ISBN #**
Text Book	TB1	**Mechanical Measurements and Metrology**, Dr. T. Chandrashekar	Edition 2013, Subhas	978-93-83214-19-8
Text Book	TB2	**Engineering Metrology,** R.K. Jain	Khanna Publishers	81-7409-153-X
References	RB1	**Metrology & Measurement,** Anand K. Bewoor & Vinay A.Kulkarni,	Tata McGraw Hill Pvt. Ltd., New-Delhi	978-0-07-014000-4
References	RB2	**Engineering Metrology,** I.C. Gupta	Dhanpat Rai Publications, Delhi.	-