CMR Institute of Technology, Bangalore			
Department: Mechanical Engineering			
Semester: 03	Section(s): A&B		
Subject: Material Science		15ME32	Lectures/week: 05
Course Instructor(s): Mr. Shreyas P.			
Course duration: AUG-2017 – DEC-2017			

LESSON PLAN

Class No.	Chapter Title / Reference Literature	Topic	Percentage of portion covered	
			Reference	Cumulative
1-15	**MODULE 1 Basics, Mechanical Behavior, Failure of Materials TB1: 1.2, 1.3, 2.1 TB2 : 1.1, 1.3, 1.6 RB1: 1.1, 1.3**	Introduction to Crystal Structure – Coordination number, atomic packing factor, Simple Cubic, BCC, FCC and HCP Structures, Crystal imperfections – point, line, surface and volume imperfections, Atomic Diffusion: Phenomenon, Fick's laws of diffusion;Factors affecting diffusion. **Mechanical Behavior**: Stress-strain diagrams showing ductile and brittle behavior of materials, Engineering and true strains, Linear and nonlinear elastic behavior and properties, Mechanical properties in plastic range. Stiffness, Yield strength, Offset Yield strength, Ductility, Ultimate Tensile strength, Toughness, Plastic deformation of single crystal by slip and twinning, Mechanisms of strengthening in metals **Fracture:** Type I, Type II and Type III, **Fatigue:** Types of fatigue loading with examples, Mechanism of fatigue, Fatigue properties, S-N diagram, Fatigue testing. **Creep:** Description of the phenomenon with examples, three stages of creep, creep properties, Stress relaxation. Concept of fracture toughness, numerical on diffusion, strain and stress relaxation	20%	20%
16-24	**MODULE -2 Alloys, Steels, Solidification TB2: 2.2, 2.4, 3.2 RB1 : 2.2, 2.6, 4.1 RB3: 2.1, 2.5, 3.5, 3.6**	Concept of formation of alloys: Types of alloys, solid solutions, factors affecting solid solubility (Hume Rothery rules), Binary phase diagrams: Eutectic, and Eutectoid systems, Lever rule, Substitutional and interstitial solid solutions, Intermediate phases, Gibbs phase rule Effect of non-equilibrium cooling, Coring and Homogenization Iron-Carbon (Cementite) diagram: description of phases, Effect of common alloying elements in steel, Common alloy steels, Stainless steel, Tool steel, Specifications of steels. Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, Crystal growth, Cast metal structures Solidification of Steels and Cast irons. Numerical on lever rule	20%	40%
25-36	**MODULE -3 Heat Treatment, Ferrous and Non-Ferrous Alloys**	Heat treating of metals: Time-Temperature-Transformation (TTT) curves, Continuous Cooling Transformation (CCT) curves, Annealing: Recovery, Recrystallization and	20%	60%

	TB1: 4.1, 4.2, 4.6 **TB2 : 3.5, 3.7, 4.1** **RB1: 3.4, 4.2, 4.3, 4.4** **RB2: 3.1, 3.3, 4.2**	Grain growth, Types of annealing, Normalizing, Hardening, Tempering, Martempering, Austempering, Concept of hardenability, Factors affecting it hardenability, surface hardening methods: carburizing, cyaniding, nitriding, flame hardening and induction hardening, Age hardening of aluminum-copper alloys and PH steels. Ferrous materials: Properties, Compositions and uses of Grey cast iron, Malleable iron, SG iron and steel,		
37-46	**MODULE -4** **Other Materials, Material Selection** **TB1: 5.1, 5.3, 5.4** **TB2 : 4.2, 4.5, 5.1** **RB2: 4.3, 4.6, 4.7**	**Ceramics:** Structure types and properties and applications of ceramics. Mechanical / Electrical behavior and processing of Ceramics. **Plastics:** Various types of polymers/plastics and their applications. Mechanical behaviors and processing of plastics, Failure of plastics. **Other materials:** Brief description of other materials such as optical and thermal materials Smart materials – fiber optic materials, piezo-electrics, shape memory alloys Shape Memory Alloys – Nitinol, superelasticity, Biological applications of smart materials - materials used as implants in human Body, Selection of Materials, Performance of materials in service Residual life assessment – use of non-destructive testing, Economics, Environment and Sustainability	20%	80%
47-52	**MODULE -5** **Composite Materials** **TB1: 6.2, 6.4, 6.5, 7.3** **TB2 : 6.1, 6.3, 6.5** **RB3: 14.3, 14.4, 15.2**	Composite materials - Definition, classification, types of matrix materials & reinforcements,Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) and Polymer Matrix Composites (PMCs), Particulate-reinforced and fiberreinforced composites, Fundamentals of production of composites, Processes for production of composites, Characterization of composites, Constitutive relations of composites, Determination of composite properties from component properties, Hybrid composites, Applications of composite materials, Numericals on determining properties of composites	20%	100%

Syllabus for Sessionals:

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 Details
Text Book	TB1	Foundations of Materials Science and Engineering, Smith	4th Edition, McGraw Hill, 2009.
Text Book	TB2	Material science and Engineering and Introduction, William D. Callister,	Wiley, 2006.
Reference Book	RB1	V.Raghavan, Materials Science and	PHI, 2002

		Engineering	
Reference Book	RB2	Donald R. Askland and Pradeep.P. Phule, The Science and Engineering of Materials	Learning, 4lh Ed., 2003.
Reference Book	RB3	George Ellwood Dieter, Mechanical Metallurgy	McGraw-Hill.

CMR Institute of Technology, Bangalore			
Department: Mechanical Engineering			
Semester: 03	Section(s): A & B		
Basic Thermodynamics		15ME33	Lectures/week: 06
Course Instructor(s): Mr. Narendra N			
Course duration: 25 July, 2017 – Nov 2017			

Lesson Plan

# Class	Chapter Title/ Reference Literature	Topic Covered	Percentage of portion covered	
			Reference	Cumulative
1-6	**Module – 1** TB1:1.1-1.7, 1.10-1.11, 2.1-2.10. RB3: 1.1-1.14	**Fundamental Concepts & Definitions:** Thermodynamic definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive, extensive properties, specific properties, pressure, specific volume Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic; processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, international fixed points and measurement of temperature. Constant volume gas thermometer, constant pressure gas thermometer, mercury in glass thermometer	12.5%	12.5%
7-12	TB1: 3.1-3.10 RB3: 2.1-2.8	**Work and Heat:** Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. **Heat;** definition, units and sign convention. Problems	12.5%	25%
13-19	**Module – 2** TB1: 4.1-4.10, 5.1-5.8. RB3: 3.1-3.12.	**First Law of Thermodynamics:** Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, Extension of the First law to control volume; steady flow energy equation (SFEE), important applications.	12.5%	37.5%
20-26	TB1:6.1-6.18. RB3: 4.1-4.15.	**Second Law of Thermodynamics:** limitations of first law of thermodynamics Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir, Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Carnot cycle, Carnot principles. Problems.	12.5%	50%
27-32	**Module - 3** TB1: 7.1-7.8, 7.12, 7.14-7.15, 8.1-8.2, 8.8. RB3: 5.1-5.11.	**Reversibility:** Definitions of a reversible process, reversible heat engine, importance and superiority of a reversible heat engine and irreversible processes; factors that make a process irreversible, reversible heat engines. Unresisted expansion, remarks on Carnot's engine, internal and external reversibility, Definition of the thermodynamic temperature scale. Problems **Entropy:** Classius inequality, Statement- proof, Entropy-definition, a property, change of entropy, entropy as a quantitative test for irreversibility, principle of increase in entropy, calculation of entropy using Tds relations, entropy as a coordinate.	12.5%	62.5%

33-39 40-45	**Module – 4** TB1: 9.1-9.9. RB3: 6.1-6.8.5.	**Availability, Irreversibility and General Thermodynamic relations:** Introduction, Availability (Exergy), Unavailable energy (anergy), Relation between increase in unavailable energy and increase in entropy. Maximum work, maximum useful work for a system and control volume, irreversibility, second law efficiency (effectiveness). Gibbs and Helmholtz functions, Maxwell relations, Clapeyron equation, Joule Thomson coefficient, general relations for change in entropy, enthalpy , internal energy and specific heats. **Pure Substances:** P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapor states of pure substance with water as example. Enthalpy of change of phase (Latent heat).Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.	12.5% 12.5 %	75% 87.5 %
46-52	**Module – 5** TB1:10.1-10.11. RB3: 8.1-8.8.	**Ideal gases:** Ideal gas mixtures, Daltons law of partial pressures, Amagat's law of additive volumes, evaluation of properties of perfect and ideal gases, Air- Water mixtures and related properties, Psychrometric properties, Construction and use of Psychrometric chart. **Real gases** – Introduction , Air water mixture and related properties, Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Redlich and Kwong equation of state Beattie-Bridgeman equation, Law of corresponding states, compressibility factor; compressibility chart. Difference between Ideal and real gases.	12.5%	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	" Basic and Applied Thermodynamics", P. K. Nag.	2nd Edition 2002, Tata McGraw Hill Publication.	978-0-07-015131-4
Reference book	RB1	"Thermodynamics, An Engineering Approach", Yunus A. Cenegal and Michael A. Boles.	2002, Tata McGraw Hill Publication.	978-0-07-026217-1
Reference book	RB2	"An Introduction to Thermodynamics", Y. V. C. Rao	1993, Wiley Eastern.	978-81-7371-4610
Reference book	RB3	"Basic Thermodynamics", R. K. Hedge and Niranjan Murthy.	1st Edition 2011, Sapna Book House,(P)Ltd., Bangalore.	978-81-280-0717-0
Data Handbooks	DH	"Thermodynamic data hand book", B. T. Nijaguna		
Data Handbooks	DH	"Properties of Refrigerant & Psychometric(tables & Charts in SI Units)", Dr. S. S. Banwait, Dr. S. C. Laroiya	2008, Birla Publication Pvt. Ltd., Delhi.	

Note: From time to time, assignments will be posted on https://sites.google.com/a/cmrit.ac.in/ /

CMR Institute of Technology, Bangalore			
Department: Mechanical Engineering			
Semester: 03	Section(s): A & B		
Subject: Mechanics of Materials		15ME34	Lectures/week: 06
Course Instructor(s): Mr. VINAY M N			
Course duration: 07/08/2017 – 25/11/2017			

LESSON PLAN

Class No.	Chapter Title / Reference Literature	Topic	Percentage of portion covered	
			Reference	Cumulative
1-14	**Module 1** Stress and Strain. TB1/ RB1	Introduction, Hooke's law	20%	20%
		Calculation of stresses in straight, Stepped and tapered sections		
		Composite sections		
		Stresses due to temperature change		
		Shear stress and strain, Lateral strain and Poisson's ratio		
		Generalized Hooke's law, Bulk modulus		
		Relationship between elastic constants		
14-26	**Module 2** Analysis of stress and strain; Cylinders. TB1/ RB1	Analysis of Stress and Strain: Plane stress, Stresses on inclined planes,	20%	40%
		Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear Stress		
		Mohr's circle for plane stress conditions		
		Cylinders: Thin cylinder: Hoop's stress		
		Maximum shear stress		
		Circumferential and longitudinal strains		
		Thick cylinders: Lames equations		
26-42	**Module 3** Shear Force and Bending Moment; Stress in beams. TB1/ TB2/ RB1	Shear Forces and Bending Moments: Type of beams, Loads and reactions, Relationship between loads	20%	60%
		Shear forces and bending moments		
		Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads and uniformly distributed constant / varying loads.		
		Stress in Beams: Pure bending, Curvature of a beam		
		Longitudinal strains in beams, Normal stresses in Beams with rectangular, circular, 'I' and 'T' cross sections		
		Flexure Formula, Bending Stresses		
		Deflection of beams (Curvature)		
42-50	**Module 4** Torsion & Columns TB1/ RB1	**Torsion:** Circular solid and hollow shafts	20%	80%
		Torsional moment of resistance, Power transmission of straight and stepped shafts		
		Twist in shaft sections, Thin tubular sections, Thin walled sections		
		Columns: Buckling and stability		
		Critical load, Columns with pinned ends, Columns with other support conditions		
		Effective length of columns		
		Secant formula for columns		
50-60	**Module 5** Strain	Strain Energy: Castigliano's theorem I and II	20%	100%
		Load deformation diagram, Strain energy due to normal stresses		

	Energy; Theories of Failure TB1/TB2/RB1	Strain energy due to Shear stresses, Modulus of resilience		
		Strain energy due to bending and torsion		
		Theories of Failure: Maximum Principal stress theory		
		Maximum shear stress theory		

Syllabus for Sessionals:

Sessional No.	Syllabus
T1	Class No. 01-14
T2	Class No. 14-50
Improvement test	Class No. 50-60

Literature:

Book Type	Code	Author & Title	Publication info	
			Edition & Publisher	ISBN No.
Text Book	TB1	Strength of Materials- Dr. R. K Bansal	4th Edition Laxmi Publications Pvt Limited, 2007	9788131800003
Text Book	TB2	Strength of Materials - S.S Bhavikatti	3rd edition 2006, Vikas Publishing House Pvt. Ltd., New Delhi.	978-81-259-2791-4
References	RB1	Strength of Materials of - R .S Khurmi	3rd Edition Published by Chand (S.) & Co Ltd ,India	8121905338

CMR Institute of Technology, Bangalore			
Department: Mechanical Engineering			
Semester: 03	Section(s): A&B		
Subject: Elements of Mechanical Engineering		15ME35A	Lectures/week: 05
Course Instructor(s): Mr. SAGAR M BALIGIDAD.			
Course duration: AUG-2017 – DEC-2017			

LESSON PLAN

Class No.	Chapter Title / Reference Literature	Topic	Percentage of portion covered	
			Reference	Cumulative
1-15	**MODULE -1 INTRODUCTION & BASIC MATERIALS USED IN FOUNDRY** TB 1: 1.1-1.12 & TB 2: 2.5 – 2.10 TB 2: 3.1 – 3.6	**Introduction:** Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy. Introduction to casting process & steps involved. Patterns: Definition, classification, materials used for pattern, various pattern allowances and their importance. **Sand molding:** Types of base sand, requirement of base sand. Binder, Additives definition, need and types **Preparation of sand molds:** Molding machines-Jolt type, squeeze type and Sand slinger. Study of important molding process: Green sand, core sand, dry sand, sweep mold, CO2 mold, shell mold, investment mold, plaster mold, cement bonded mold.Cores: Definition, need, types. Method of making cores, concept of gating (top, bottom, parting line, horn gate) and risering (open, blind) Functions and types	20%	20%
16-24	**MODULE -2 MELTING & METAL MOLD CASTING METHODS** TB 2 : 4.1 – 4.8 TB 1: 4.1 – 4.3	**Melting furnaces:** Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features & working principle of cupola furnace. **Casting using metal molds:** Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixocasting, and continuous casting processes	20%	40%
25-36	**MODULE -3 SOLIDIFICATION & NON FERROUS FOUNDRY PRACTICE** TB 2 : 6.1 – 6.8 TB 1: 5.1 – 5.3	**Solidification**: Definition, Nucleation, solidification variables, Directional solidification-need and methods. Degasification in liquid metals-Sources of gas, degasification methods. **Fettling and cleaning of castings:** Basic steps involved. Sand Casting defects- causes, features and remedies. Advantages & limitations of casting process **Nonferrous foundry practice**: Aluminum castings - Advantages, limitations, melting of aluminum using lift-out type crucible furnace. Hardeners used, drossing, gas absorption, fluxing and flushing, grain refining, pouring temperature. Stir casting set up, procedure, uses, advantages and limitations.	20%	60%
37-46	**MODULE -4 WELDING PROCESS**	**Welding process:** Definition, Principles, Classification, Application, Advantages & limitations of welding. Arc welding: Principle, Metal arc welding (MAW), Flux Shielded Metal	20%	80%

	TB 1: 6.1 - 6.12 & TB 2: 5.5 – 5.10 TB 2: 6.1 – 6.6	Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding (AHW). **Special type of welding:** Resistance welding principles, Seam welding, Butt welding, Spot welding and Projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and electron beam welding.		
47-52	**MODULE -5 SOLDERING , BRAZING AND METALLURGICAL ASPECTS IN WELDING** TB 1: 9.1-9.12 & TB 2: 7.5 – 7.10 TB 2: 8.1 – 8.6	Structure of welds, Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ. Effect of carbon content on structure and properties of steel, Shrinkage in welds& Residual stresses, Concept of electrodes, filler rod and fluxes. Welding defects- Detection, causes & remedy. **Soldering, brazing, gas welding:** Soldering, Brazing, Gas Welding: Principle, oxy-Acetylene welding, oxy-hydrogen welding, air-acetylene welding, Gas cutting, powder cutting. **Inspection methods:** Methods used for inspection of casting and welding. Visual, magnetic particle, fluorescent particle, ultrasonic. Radiography, eddy current, holography methods of inspection.	20%	100%

Syllabus for Sessionals:

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

TEXT BOOKS:

[1] **"Manufacturing Process-I",** Dr.K. Radhakrishna, Sapna Book House, 5th Revised Edition 2009.
[2] **"Manufacturing Process-I",** Mr. Sagar M B, Sunstar Publication, 1st Edition 2014.
[3] **"Manufacturing & Technology**: Foundry Forming and Welding", P.N. Rao, 3rd Ed., Tata McGraw Hill, 2003.

REFERENCE BOOKS:

[1] **"Process and Materials of Manufacturing**", Roy A Lindberg, 4th Ed. Pearson Edu. 2006.
[2] **"Manufacturing Technology**", Serope Kalpakjian, Steuen. R. Sechmid, Pearson Education Asia, 5th Ed. 2006.
[3] **"Principles of metal casting"**, Rechard W. Heine, Carl R. Loper Jr., Philip C. Rosenthal, Tata McGraw Hill Education Private Limited Ed.1976.

CMR Institute of Technology, Bangalore		
Department(s): Mechanical Engineering		
Semester: 03	Section(s): 3 A & B	
Computer Aided Machine Drawing	15ME36A	Lectures/week: 05
Course Instructor(s): Puneeth Kumar N		
Course duration: 7th Aug. 2017 – 25th Nov. 2017		

LESSON PLAN

Lecture #	Text Book / Reference	Topics	Percentage of portion covered	
			Individual	Cumulative
1-2	TB1-1.1, 1.2, 1.3, 1.4, 1.5, 1.6 TB2- 2.1, 2.2	**Introduction to Machine Drawing**	-	-
3-14	TB1-2.1, 2.2, 2.3 RB1-1.1, 1.2, 1.3.1.4, 1.5, 1.6&1.7	**Section of solids**- Section of Pyramids	15%	15%
		Section of Tetrahedron & Cones		
		Section of Cubes, Prisms & Cylinders		
15-20	TB1- 3.1, 3.2 RB1-2.1 to 2.6	**Orthographic Projections** introduction & problems	10%	25%
21-24	TB1-4.1, 4.2 TB2-7.1, 7.2 RB1-4.1 To 4.4	**Thread Forms**- Section Views of threads	5%	30%
		Types of Threads		
25-30	TB1-5.1, 5.2, 5.3 RB2-4.12, 4.13	**Fasteners-** introduction, types of bolts & Nuts- Hexagonal headed Bolt and Nut	10%	40%
		Square headed Bolt and Nut		
31-44	TB1-9.1 to 9.6, 9.8 RB1-11.1 to 11.5, 11.8 to 11.10 & 11.13	**Assembly Drawing**- Screw Jack	40%	80%
		Plummer Block		
		Machine Wise		
		Tool post of a Lathe		
		IC Engine connecting Rod		
		Rams Bottom Safety Valve		
		Tail Stock of a Lathe		
45-52	TB1- 7.1 to 7.7 RB1-5.1 to 5.5, 5.10	**Riveted Joints**- Lap joints (Single and Double)	5%	85%
		Butt Joints (Single and Double)		
53-56	TB1-6.1-6.5 RB-7.1 to 7.3	**Keys & Joints**- Cotter Joint (Socket& Spigot Type)	5%	90%
		Knuckle Joint(Pin Type)		
57-60	TB1-8.1to8.6 RB1-8.3, 8.5, 8.7, 8.9	**Couplings**- introduction and types	10%	100%
		Types Cont…		

Syllabus for Internal Assessment Tests (IAT)*

IAT #	Syllabus
T1	Class # 01 – 25
T2	Class # 26 – 50
Improvement Test	Class # 51- 60

*** See calendar of events for the schedules of IATs.**

Literature:

Book Type	Code	Author & Title	Publication information	
			Edition & Publisher	**ISBN #**
Text Book	TB1	Published by VTU belgum, "A primer on Computer Aided Machine Drawing"	2007, VTU Belgum	
Text Book	TB2	N D Bhatt & V M Panchal "Machine Drawing"	Charotar 43rd Eidition 2008	978-81-85594-84-2
References	RB1	K R Gopalakrishna "Machine Drawing	19th VTU edition Sept-2005. Subhas stores	