MATERIAL SCIENCE AND TECHNOLOGY

[As per Choice Based Credit System (CBCS) scheme] SEMESTER – III

Subject Code	15MT32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

To gain an understanding of the relationships between the structures, properties, processing and applications of various engineering materials.

Modules	**Hours Teaching**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Mechanical Behavior : Stress- Strain diagram showing ductile and brittle behavior of materials, Liner and non-linear elastic behavior and properties, mechanical Properties in plastic range, Yield strength offset yield strength, ductility, ultimate tensile strength, toughness plastic deformation of single crystal by slip and twinning. Atomic diffusion, flick's laws of Diffusion, Factors attaching the Diffusion **Fracture:** Types, creep: Description of the phenomenon with examples, 3 stages of creep properties, stress relaxation fatigue: types of fatigue lauding with examples, Mechanism of fatigue, Fatigue properties, Fatigue testing and S-N diagram.	**10 Hours**	
Module -2		
Heat Treating of metals: TTT curves, Continuous cooling curves, Annealing and its types, Normalizing, Hardening, Tempering, Martempering, Austemparing, hardenability, Surface hardening methods like Carburizing, Cyaniding Nitriding, flame hardening and induction hardening, age hardening of aluminum and copper alloys.	**10 Hours**	

Ferrous and non ferrous materials: Properties composition and use of grey cush iron, malleable iron, SG iron and steel. Copper alloys- brasses and bronzes, aluminum alloys Al-Cu, Al-Si, Al-Zn alloys.		
Module -3		
Solidification and phase diagram: Mechanism of solidification, Homogenous and Heterogeneous nucleation. Cristal Growth, Cast metal strictures, Phase diagram. Solid solutions Substitution and Interstitial solid solution, Hume rothary rule, Intermediate phase, construction of equilibrium diagram involving complete and partial solubility, lever rule, Gibb's phase rule.	**10 Hours**	
Module -4		
Composite materials: Definition, classification, type of matrix materials and reinforcements, advantages and application of composites**.** **Processing of FRP Composites:** Layup and curing, fabricating process, open and closed mould process, hand layup technique; structural laminate bag molding, production procedures for bag molding; filament winding, pultrusion, pulforming, thermo-forming, injection molding, blow molding. **Metal Matrix Composites:** Reinforcement materials, types, characteristics and selection, base metals selection. Need for MMC's and its application.	**10 Hours**	
Module -5		
Smart Materials: Piezoelectric Materials, Electrostrictive Materials, Magnetostrictive Materials, Magnetoelectric Materials. Magnetorheological Fluids, Electrorheological Fluids, Shape Memory Materials, Fiber-Optic Sensors. Smart Sensor, Actuator and Transducer Technologies: Smart Sensors: Accelerometers; Force Sensors; Load Cells; Torque Sensors; Pressure Sensors; Microphones; Impact Hammers	**10 Hours**	

Course outcomes:

At the end of the course, the students will be able to:

- Appreciate the necessity of engineering materials, Smart Sensors and its applications in various fields.
- Identify possible cause of failure due to fatigue and Creep.
- Demonstrate the knowledge of nucleation, Crystal growth, Solid solution and Phase diagrams.
- Appreciate the significance and applications of Various heat treatment processes.
- Explain the definition and classification and fabrication processes of composite materials.

MECHANICS OF MATERIALS

[As per Choice Based Credit System (CBCS) scheme] SEMESTER – III

Graduate Attributes (as per NBA):

Question paper pattern:

- The question paper will have TEN questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with maximum of FOUR sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Materials Science and Engineering,William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition, 2001.
2. Mechanics of Composite Materials, Second Edition, Autar K. Kaw, CRC Press, 2005.
3. Smart Materials and Structures - M. V. Gandhi and B. So Thompson - Chapman & Hall, London; New York - 1992 (ISBN: 0412370107).
4. Materials Science and Engineering,William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition, 2001
5. Materials Science, Shackleford.,& M. K. Muralidhara, Pearson Publication – 2007.
6. "Material Science & Metallurgy For Engineers", Dr. V.D. Kodgire& S. V. Kodgire, Everest Publication.
7. "Mechanical Behavior & Testing Of Materials", A. K. Bhargava, C.P. Sharma.P H I Learning Private Ltd.

Reference Books:

1. An Introduction to Metallurgy; Alan Cottrell, Universities Press India Oriental Longman Pvt. Ltd., 1974.
2. Engineering Materials Science, W.C.Richards, PHI, 1965
3. Physical Metallurgy; Lakhtin, Mir Publications
4. Materials Science and Engineering, V.Raghavan,PHI, 2002
5. Elements of Materials Science and Engineering, H. VanVlack, Addison- Wesley Edn., 1998
6. Materials Science and Engineering,William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition, 2001.
7. The Science and Engineering of Materials, Donald R. Askland and Pradeep.P. Phule, Cengage Learning, 4th Ed., 2003.

Subject Code	15MT33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course is designed to introduce basic principles of statics for deformable bodies. The main objective is to help the students develop an intuition for equilibrium, properly constrained systems, and deformation under external loadings. It is also anticipated that the theory and design approach for the mechanics of deformable bodies will help prepare the students for complex systems that will be encountered in advanced design courses.

Modules	**Hours Teaching**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Simple Stress and Strain: Introduction, Concept of Stress and Strain, Linear elasticity, Hooke's Law and Poisson's ratio. Extension / Shortening of a bar, bars with varying cross sections (step and tapering circular and rectangular), Elongation due to self weight, Principle of super position, St. Venant's Principle. **Simple shear stress and Shear strain. Volumetric strain**: expression for volumetric strain, Elastic Constants and relations. Stresses in Composite Section and temperature stresses (No numerical).	**10 Hours**	
Module -2		

Compound Stresses: Introduction, Concept of Plane stress, Stress tensor for plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress. **Thick and Thin Cylinder** Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lame's equation (compound cylinders not included).	**10 Hours**	
Module -3		
Bending Moment and Shear Force in Beams: Introduction, Sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for Cantilever, simply supported and overhanging beams subjected to concentrated loads, uniformly distributed load (UDL), uniformly varying load (UVL) and couple, simple numerical.	**10 Hours**	
Module -4		
Bending and Shear Stresses in Beams: Introduction, Theory of simple bending, assumptions in simple bending. General equation for bending. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, symmetrical I and T sections. (Composite / notched beams not included). **Deflection of Beams**: Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and Macaulay's method for simply supported beams for point load, UDL and Couple. (Simple Numericals)	**10 Hours**	
Module -5		
Torsion of Circular Shafts: Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts. **Elastic Stability of Columns:** Euler's theory for axially loaded elastic long columns. Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.	**10 Hours**	

CONTROL SYSTEMS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Course outcomes:

At the end of the course, the student will be able to:

CO1: Analyze the normal stresses and strains for axially loaded members using Hooke's law
CO2: Enumerate principal stresses and shear stresses for simple two dimensional loadings
CO3: Elucidate the stresses and strains in thick and thin cylindrical pressure vessels.
CO4: Perform analysis of beams for static loading.
CO5: Design torsional shafts and structural columns

Graduate Attributes (as per NBA):

Question paper pattern:

- The question paper will have TEN questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with maximum of FOUR sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. **"Mechanics of Materials",** by R.C.Hibbeler, Prentice Hall. Pearson Edu., 2011.
2. **"Mechanics of materials",** James.M.Gere, Thomson, Eighth edition2013.
3. **"Mechanics of materials",** in SI Units, Ferdinand Beer & Russell Johston, 5th Ed., TATA McGraw Hill-2003.
4. **"Mechanics of Materials",** K.V. Rao, G.C. Raju, Subhash Publication, Fourth Edition, 2013

Reference Books:

1. **"Strength of Materials",** S.S. Rattan, Tata McGraw Hill, 2009.
2. **"Strength of Materials",** S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.
3. **"Engineering Mechanics of Solids**", Egor.P. Popov, Pearson Edu. India, 2nd, Edition, 1998.
4. **"Strength of Materials",** W.A. Nash, 5th Ed., Schaum's Outline Series, Fourth Edition-2007.

Subject Code	15MT34	IA Marks	20
Number ofLecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

The main objective of this course is to teach the fundamental concepts of Control systems, mathematical modeling of the system and to study the concept of time response and frequency response of the system and teach the basics of stability analysis of the system.

Modules	Hours Teaching	RevisedBloom's Taxonomy(RBT) Level
Module -1		
Modeling of Systems and Block diagram: Introduction to Control Systems, Types of Control Systems, with examples. Concept of mathematical modeling of physical systems- Mechanical, Translational (Mechanical accelerometer, systems excluded), and Rotational systems, Analogous systems based on force voltage analogy and force current analogy. Introduction to Block diagram algebra. Numerical problems on all topics.	**10 Hours**	
Module -2		
Signal Flow graph: Introduction to Signal Flow graph, Mason's gain formula. Obtaining Transfer functions for the given SFG using Mason's gain formula. **Time response analysis:** Introduction. Standard test signals, response of first order & second order systems for unit step input. Steady state errors & Error constants. Numerical problems on all topics.	**10 Hours**	
Module -3		
Concepts of stability: The Concept of stability. Necessary conditions for stability. Hurwitz stability criterion. Routh stability criterion. Relative stability analysis using RH Criterion. **The Root Locus Technique:** Introduction. Root locus concepts. Construction of root loci. Stability analysis using Root locus Technique Numerical problems on all topics.	**10 Hours**	
Module -4		
Frequency domain Analysis: Introduction to frequency domain analysis, Correlation between time & frequency response, Bode plots. Polar Plot: Introduction to Polar plot and Nyquist plots, Nyquist stability criterion. Stability analysis using Polar plot. Numerical problems on all	**10 Hours**	

ANALOG & DIGITAL ELECTRONICS

[As per Choice Based Credit System (CBCS) scheme] SEMESTER – III

Module -5		
State space Analysis: Concept of state, state variables and state model. State diagrams and State models for Linear continuous-time systems (Electrical systems): State space representation using Physical and Phase variables. Derivation of transfer functions from the state model. Numerical problems on all topics. **Solution of state equations:** Solutions of homogeneous and Nonhomogeneous state equations. Properties of state transition matrix, computation of state transition matrix by matrix exponential and Laplace transform method. Numerical problems	**10 Hours**	

Course outcomes:

After studying this course, students will able to:

- Apply modeling knowledge in implementation physical systems.
- Understand the reduction of block diagram & analyze using Signal flow graph.
- Comment on performance of a system by evaluating various parameters.
- Model a system by applying the concept of State Space analysis
- Design and develop portable control systems

Graduate Attributes (as per NBA):

Question paper pattern:

- The question paper will have TEN questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with maximum of FOUR sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. "Control Systems Engineering", I.J. Nagarath and M. Gopal ,New Age International (P) Limited, Publishers, Fifth edition – 2012.

2. "Modern Control Engineering ", K. Ogata, Pearson Education Asia/ PHI, 4th Edition, 2002.

Reference Books:

1. "Automatic Control Systems", Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008. 2. "Feedback and Control System", Joseph J Distefano III et al., Schaum's Outlines, TMH, 2nd Edition 2007

Subject Code	15MT35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

The main objective of this course is to make students understand the basic analog and digital electronics, including semiconductor properties, operational amplifiers, combinational and sequential logic and analog-to-digital digital-to-analog conversion techniques. Finally, students will gain experience in with the design of analog amplifiers, power supplies and logic devices.

Modules	Hours Teaching	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Diode Applications : PN junction Diode, VI-Characteristics, Junction diode Models, Junction Diode as switch, Diode specifications, Circuit applications of diodes, Smoothing circuits, Zener diode voltage Regulators.	**10 Hours**	
Module -2		
Op-Amp active filters and oscillators : Active filters, I & II order low pass filter, I and II order high pass filters, wide Band pass and Band reject filter, phase shift oscillator, wein bridge oscillator.	**10 Hours**	
Module -3		
Comparators and 555 timers: Basic compartors, zero crossing detector, schimitt trigger, the 555 timers, monostable multivibrator, astable multivibrator, applications of astable multivibrator.	**10 Hours**	
Module -4		
Logic families: Digital circuits, basic logic operations, the NOR & NAND logic gates, other IC logic gates, logic gates characteristics, the TTL logic, CMOS logic family, emitter coupled logic. **Sequential circuits:** RS latch, Flip flops, JK flip flop, digital registers, binary and decade counters, read and write memories.	**10 Hours**	

Computer Organization

[As per Choice Based Credit System (CBCS) scheme] SEMESTER – III

Module -5

Combinational circuits: multiplexers, demultiplixers, encoders, decoders, adders **Analog – Digital Converters:** Quantization of analog signals, DAC, ADC, digital instrumentation System.	**10 Hours**	

Course outcomes:

By the end of the course the student will be able to:

1. Analyze the Importance & Applications of Diode as Rectifiers, Filters, Zener Diode Regulators & Switching Circuits.
2. With the Knowledge of Active Filters & Oscillators students can better understand the Real-time Communication Systems.
3. Students are prepared to Understand, Analyze & Design Various Analog Electronics circuits if recruited to Analog Electronics Industry.
4. Students are prepared to Understand, Analyze & Design Digital Circuits, if interested to work in VLSI Industry.

Graduate Attributes (as per NBA):

Question paper pattern:

- The question paper will have TEN questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with maximum of FOUR sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. "Electronic Circuits and systems- analog and digita l", Y.N Bapat 1992 edition, Tata Mc GrawHill.
2. "Opamp and Linear Integrated Circuits", Ramakant A Gayakwad 3rd edition, PHI.
3. "Digital Logic and Computer Design", M Morris Mano, 2001 ledition, PHI.

Reference Books:

1. "Digital Electronics: Principles and Integrated cir cuits", Anil K Maini, 2008, wiley India.
2. "Linear Integrated Circuits", D. Roy Choudhury and Shail B Jain, 2nd edition, Reprint 2006, New Age International.
3. "Digital Principles and applications", Malvino & Leach, Tata Mc. Graw Hill.

Subject Code	15MT36	IA Marks	20
Number of LectureHours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course enables students to:

- Describe basic structure of computers, machine instructions and programs.
- Describe different addressing modes, output operations, Stacks and Queues, Subroutines and Additional Instructions, IEEE standard for Floating point Numbers.
- Understand the accessing of I/O Devices, Interrupts, Direct Memory Access, Busses, Interface Circuits, and Standard I/O Devices.
- Know the concepts of Semiconductor RAM Memories, Read Only Memories, Cache Memories, Performance Considerations and Virtual Memories.
- Execute a Complete Instruction, Multiple Bus Organization, Microprogrammed Control and Hardwired Control.

Modules	Hours Teaching	Revised Bloom'sTaxonomy(RBT)Level	
Module -1			
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation. **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing.	**10 Hours**		
Module -2			
Machine Instructions and Programs (Continued): Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions. IEEE standard for Floating point Numbers (6.7.1 of Chapter 6)	**10 Hours**		

Module -3		
Input/output Organization: Accessing I/O Devices, Interrupts, Direct Memory Access, Busses, Interface Circuits, Standard I/O Devices.	**10 Hours**	
Module -4		
Memory System: Some Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Cache Memories, Performance Considerations, and Virtual Memories.	**10 Hours**	
Module -5		
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Microprogrammed Control, Hardwired Control.		

Course outcomes:

After studying this course, students will be able to:

1. Understand the basic structure of computer and machine instructions.
2. Understand the interfacing concepts.
3. Understand the concepts of memory system.

Graduate Attributes (as per NBA):

Question paper pattern:

- The question paper will have TEN questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with maximum of FOUR sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", McGraw Hill, 5th Edition, 2015, ISBN:9781259005275.

Reference Books:

1. David A. Patterson, John L. Hennessy, "Computer Organization and Design – The Hardware / Software Interface ARM", Elsevier.

2. William Stallings, "Computer Organization & Architecture", Pearson.

3. Vincent P. Heuring & Harry F. Jordan, "Computer Systems Design and Architecture", Pearson.

ANALOG AND DIGITAL ELECTRONICS LAB

[As per Choice Based Credit System (CBCS) scheme] SEMESTER – III

MECHANICAL LAB-01

[As per Choice Based Credit System (CBCS) scheme] SEMESTER – III

Subject Code	15MTL37	IA Marks	20
Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	-	Exam Hours	03

CREDITS – 02

Course objectives:

- Understand the characteristics and behavior of Engineering materials used for engineering applications.
- To provide training to students to enrich their practical skills.

Laboratory Experiments:	**Revised Bloom'sTaxonomy (RBT)Level**

Part-A

1. Tensile, shear and compression tests of metallic specimens using Universal Testing machine. 2. Torsion Test. 3. Bending Test on Non metallic specimens. 4. Izod and Charpy tests on M.S Specimen. 5. Brinell and rockwelll hardness test.	

Part-B

1. Preparation of two models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling. 2. Demonstration on cutting the V Groove using a shaper and cutting a gear teeth using Milling Machine.(Not for Examination)	

Course outcomes:

By the end of the course the student will be able to:

5. Demonstrate the knowledge & skill to conduct and analysis the result with respect to Hardness testing, and different loads.
6. Demonstrate the various skills of Turning Facing, Knurling and Thread cutting using lathe.

Graduate Attributes (as per NBA):

Scheme of Examination:

One Question From Part – A : **30marks**
One Question From Part - B : **40 Marks**
Viva- Voice : **10 Marks**
Total : **80 Marks**

Subject Code	15MTL38	IA Marks	20
Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	-	Exam Hours	03

CREDITS – 02

Course objectives:

1) Is to understand the characteristics and working of analog and digital components.

2) Is to design and develop analog and digital applications

Laboratory Experiments:	**Revised Bloom's Taxonomy (RBT) Level**
1. Clipper circuits and Clamper circuits using diodes. 2. Single stage RC coupled amplifier using BJT and its frequency respons. 3. Invering Amplifier, Non inverting Amplifier, voltage Follower using Opamp. 4. Astable and Monostable multivibrator using timer 555. 5. RC phase shift Oscillator using BJT. 6. Simplification and realization of Boolean expression using logic gates/ universal gates. 7. Half adder and Full Adder using logic gates. 8. Decoder and Encoders 9. Multiplexers and demultiplexers. 10. Design and development of counters.	

Course outcomes:

By the end of the course the student will be able to:

1. Analyze the Importance & Applications of Diode as Rectifiers, Filters, Zener Diode Regulators, Switching Circuits &Filters.
2. Design and Develop Analog and Digital Circuits.
3. Understand, Design and Develop counters, Registers for memory applications.

Graduate Attributes (as per NBA):

Scheme of Examination:

One Question : **70 marks**

Viva- Voice : **10 Marks**

Total : **80 Marks**