Faculty of Engineering &Technology
KAKATIYA UNIVERSITY, WARANGAL-506009
Department of Mechanical Engineering

B. Tech. (ME) III SEMISTER

Sl. No	Category/ Code	Course Title	L	T	P	Credits
1	BSC-105	Mathematics - III	3	0	0	3
2	MC-210	Environmental Science	2	0	0	0
3	ME-211	Thermodynamics	3	0	0	3
4	ME-212	Mechanics of Solids	3	0	0	3
5	ME-213	Material Science and Metallurgy	3	0	0	3
6	ME-214	Manufacturing Science	3	0	0	3
7	ME-215L	Material Testing and Metallurgy Lab	0	0	3	1.5
8	ME-216L	Manufacturing Science Lab	0	0	3	1.5
9	ESC-106	Applied Electronics	3	0	0	3
10	ESC-106L	Applied Electronics-Lab	0	0	2	1
		Total Contact Hours	29			22

[L= Lectures, T= Tutorials, P= Practical, C= Credits]

Faculty of Engineering &Technology
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Department of Mechanical Engineering

B. Tech. (ME) III SEMISTER
BSC-105
Mathematics - III

Statistics, Probability, and Numerical Techniques

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	0	0	3	External Marks: 70

Module1: Statistical Methods

Introduction, Collection of Data, Graphical Representation, Measures of Dispersion, Moments, Skewness, Kurtosis, Correlation, Coefficient of Correlation, Lines of Regression.

(Sections 25.1, 25.2, 25.3, 25.6, 25.9, 25.10, 25.11, 25.12, 25.13, 25.14 of Text Book)

Module2: Probability & Distributions

Probability, Addition Law of Probability, Independent Events, Baye's Theorem , Random Variable, Continuous Probability Distribution, Expectation, Moment Generating Function, Binomial Distribution , Poisson Distribution, Normal Distribution, Exponential Distribution. (Sections26.1,26.4,26.5,26.6,26.7,26.9,26.10,26.11,26.14,26.15,26.16,26.19(6) of Text Book)

Module3: Numerical Techniques-I

Solution of Algebraic and Transcendental Equations, Principle of Least Squares, Method of Least Squares, Fitting of Other Curves, Finite Differences, Forward Differences, Backward Differences. (Sections 28.2, 24.4, 24.5, 24.6, 30.2, 30.2(1), 30.2(2) Of Text Book)

Module4: Numerical Techniques-II

Central Differences, Other Difference Operators, Newton's Interpolation Formulae, Gauss's Forward Interpolation Formula, Interpolation with Unequal Intervals, Numerical Differentiation. Sections 29.7, 29.4, 29.6, 29.7(1), 29.9, 30.1.of Text Book)

Module5: Numerical Techniques-III

Numerical Integration, Trapezoidal Rule, Simpson's one –third Rule, Simpson's three-eight Rule, Weddle's Rule, Solution of Simultaneous Linear Equations (Iterative Methods)

(Sections 30.4, 30.6, 30.7, 30.8, 30.10, 28.5 of Text Book)

Text Book:

B.S Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publications.

References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons

2. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand &Sons

3. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Pvt. Ltd.

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B. Tech. (ME) III SEMISTER
MC 210
ENVIRONMENTAL SCIENCES

Teaching Scheme				Examination Scheme	
L	**T**	**P**	**C**	CIE	ESE
2	0	0	0	30 Marks	70 Marks

UNIT–I (8)

Introduction to Environmental Science: Environment and society, major environmental issues: Ozone layer depletion, Acid rains, global climate change etc, sustainable development,
Environmental impact assessment, environmental management

Natural Resources Utilization and its Impacts: Energy, minerals, water and land resources, Resource consumption, population dynamics, urbanization..

UNIT–II (8)

Ecology and Biodiversity: Energy flow in ecosystem, food chain, nutrient cycles, eutrofication value of biodiversity, biodiversity at global, national and local levels, threats for biodiversity, conservation of biodiversity.

UNIT–III (8)

Water Pollution: Sources, types of pollutants and their effects, water quality issues, contaminanttransport, self-purification capacity of streams and water bodies, water quality standards, principles of water and wastewater treatment.

UNIT–IV (8)

Air Pollution: Sources, classification and their effects, Air quality standards, dispersion of pollutants, control of air pollution, automobile pollution and its control.

UNIT–V (8)

Solid Waste Management: Sources and characteristics of solid waste, effects, Collection and transfer system, disposal methods.

Text Books:

1. M. Chandrasekhar, Environmental science, Hi Tech Publishers, 2009.
2. P.N. Modi (2006), Water supply Engineering – Environmental Engineering (Vol. I) – Standard Book House.
3. Gerard Kiely, Environmental Engineering, McGraw Hill Education Pvt Ltd, Special Indian Edition, 2007.

References:

1. W P Cunningham, M A Cunningham, Principles of Environmental Science, Inquiry and Applications, Tata McGraw Hill, Eighth Edition, 2016.

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B. Tech. (ME) III SEMISTER
ME - 211
THERMODYNAMICS

Course code	PCC				
Category	Professional Core Course				
Course title	**Thermodynamics**				
Scheme and Credits	L	T	P	Credits	Internal marks = 30
	3	0	-	3	External Marks = 70

UNIT-I

Concepts of System, **Surroundings and Universe**. Types of systems. Classification of Properties- fundamental and secondary, intensive and extensive. Basic laws of Thermodynamics. Thermodynamic equilibrium. Types of thermodynamic processes and their representation on P-V and T-s plots. Types of cycles- Open and Closed. Ideal Gases- Equation of State. Specific Heats, Enthalpy, Internal energy, & Entropy. Real Gases-vander Waals Equation of State, Compressibility Factor.

UNIT-II

First Law analysis of Closed Systems: First law of thermodynamics. Heat and work transfers. Energy conservation equation for a closed system. Calculation of Work Transfer, Heat Transfer, and Internal Energy changes.

First Law analysis of Open Systems: Derivation of Unsteady Flow Energy Equation (UFEE) and Steady Flow Energy Equation (SFEE). Calculation of Work Transfer, Heat Transfer, and Enthalpy changes. Thermodynamic analysis of flow through Nozzles, Diffusers, Turbines, Compressors, Throttling devices and Heat Exchangers.

Application of Unsteady Flow Energy Equation (UFEE) : Calculation of Heat transfer during charging /evacuation of a Cylinder.

UNIT-III

Carnot Cycle- Thermodynamic analysis of Carnot Cycle. Applications of Carnot cycle -Heat Engine, Heat Pump and Refrigerator.

Second Law of Thermodynamics: Statements of Second Law of thermodynamics. Equivalence of Kelvin-Planck and Clausius Statements. Clausius Inequality, Carnot Theorems, Thermodynamic Temperature Scale.
Concept of Entropy: Reversible and Irreversible processes. Calculation of Entropy change during various thermodynamic processes. Principle of Increase of Entropy. Second law analysis of a control Volume.

Concepts of Exergy and Anergy: Loss in available energy. Second law efficiency of Turbines and Compressors.

UNIT-IV

Pure Substances. Concept of Phase Change. Graphical representation of thermodynamic processes on P-V, P-T, T-V, T-s, h-s, P-h and P-V-T diagrams. Thermodynamic relations involving Entropy, Enthalpy and Internal Energy. Derivation of Maxwell's relations. Clapeyron equation.

Properties of Steam- Use of Steam Tables and Mollier diagram. Power Plant Cycles-Carnot and Rankine Cycles and their representation on P-V, T-s and h-s diagrams. Evaluation of performance parameters–Efficiency, Work ratio, Specific Steam Consumption and Heat Rate.

UNIT-V

Non reactive Ideal homogenous gas Mixtures: Determination of properties of Mixture in terms of properties of individual components of the mixture. Gibbs Phase Rule.

Psychrometry : Moist Air Properties. Use of Psychrometric Chart and Tables.

Concept of Air-Conditioning: Heating, Cooling, Humidification and De-humidification and other psychrometric processes. Adiabatic Mixing of two Streams of Moist Air. Sensible heat factor and Bypass factor for heaters/coolers. Introduction to summer and winter air-conditioning processes with a brief overview on devices used in Air Conditioning.

TEXT BOOKS

1. Yunus Cengel, Michael Boles "*Thermodynamics: An Engineering Approach",* McGraw-Hill Education; 8 edition, 2017
2. Nag P.K, "*Engineering Thermodynamics*': Tata McGraw Hill Publishing, 6th Edn, 2017.

REFERENCE BOOKS:

1. Richard E.Sonntag, C.Borgnakke, G.J Van Wylen, *"Fundamentals of Thermodynamics':* John Wiley & Sons, 7th Edn., 2009.
2. Rajput R K, " *Engineering Thermodynamics*" Laxmi Publications, 4th Edition, 2016
3. Fundamentals of Classical Thermodynamics by G. Van Wylan& R.E. Sonntag, John Wiley Pub.6. Thermodynamics by Achutan, PHI.

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B. Tech. (ME) III SEMISTER
ME - 212
MECHANICS OF SOLIDS

Course code	PCC				
Category	Professional Core Course				
Course title	**Mechanics of Solids**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Internal marks = 30
	3	**0**	**-**	**3**	External Marks = 70

UNIT-I:

SIMPLE STRESSES AND STRAINS: Elasticity and plasticity – Types of stresses and strains – Hooke's law –stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars –Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings. Principal stresses, principal planes, the Mohr Diagram, Plane-Stress and Plane-Strain conditions.

UNIT-II:

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads , U.D.L, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT-III:

FLEXURAL STRESSES:
Theory of simple bending – Assumptions Derivation of bending equation: $M/I=\sigma/y=E/R$ Neutral axis – Determination bending stresses – section modules of rectangular and circular sections (Solid and Hollow),I, T, Angle and Channel sections – Design of simple beam sections. Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT-IV:

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L. uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

TORSION OF CIRCULAR SHAFTS: Theory of pure torsion in solid and hollow circular shafts, torsional shear stresses and angle of twist, transmission of power, compound shafts, torsion of tapered shafts.

UNIT-V:

THIN CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

THICK CYLINDERS : Lame's equation – cylinders subjected to inside and outside pressures – compound cylinders.

TEXT BOOKS:

1. Strength of Materials by Andrew Pytel and Ferdinond L. Singer: Longman Publications
2. Strength of Materials by Jondar :Galgotia Publications

REFERENCE BOOKS:

1. Strength of Materials by Bansal, Lakshmi Publications
2. Strength of Materials by S. Tumoshenko
3. Strength of Materials by R.S. Khurmi; S. Chand & Co. 2005

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B. Tech. (ME) III SEMISTER
ME - 213
MATERIAL SCIENCE & METALLURGY

Course code	PCC				
Category	Professional Core Course				
Course title	**Material Science and Metallurgy**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Internal marks = 30
	3	**0**	**-**	**3**	External Marks = 70

UNIT–I

Crystal Structure: Unit cells, Metallic crystal structures. Imperfection in solids: Point, line, interfacial and volume defects;

Fracture: Types of fracture in metals, modes of fracture, Ductile and brittle failure mechanisms, Griffith criterion for brittle materials.

Creep: Creep strength, Creep curve, Creep Test.

Fatigue: SN curve, endurance limit, Experimental determination of Fatigue strength.

UNIT-II

Plain Carbon Steels ,Alloying of steel, properties of stainless steel and tool steels, maraging steels; cast irons: grey, white, malleable and spheroidal cast irons;

Non-ferrous metals: Copper and copper alloys, Aluminium and Al-Cu–Mg alloys, Nickel based super alloys and Titanium alloys

UNIT-III

Ceramics - Crystalline ceramics, Glasses, Properties and applications of ceramics;

Polymers - Polymerization, Thermoplastics and thermosetting plastics, Properties and applications of polymers; Methods of processing of plastics;

Composites - Concept of composites, Matrix and reinforcement, Rule of mixtures, Classification of composites, Applications of composites.

UNIT-IV

Phase diagrams: Substitutional and interstitial solid solutions. Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron.

UNIT-V

Heat Treatment of steel: Annealing, Normalizing, Hardening, Tempering. isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties. Austempering and Martempering. Case Hardening: Carburizing, Nitriding, Carbo-nitriding, Flame Hardening, Induction Hardening.

TEXT BOOKS:

1. W. D. Callister, 2007, adapted by R.Balasubramaniam, “Materials Science and Engineering”, 7th Edition, Wiley India.
2. Kodgire V.D, Kodgire S.V., “Material Science and Metallurgy For Engineers” Everest Publishing House, 42nd Edition, 2018

REFERENCE BOOKS:

1. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
2. Avner S.H, "Introduction to Physical Metallurgy", McGraw Hill Publishing Co. Ltd., 2nd Edition, 1974.
3. Nayak S.P, "Engineering Metallurgy And Material Science”: Charotar Publishing House, 6th Edn., 1995.
4. Raghavan V, "Material Science and Engineering", Prentice Hall of India Ltd., 4th Edition, 199

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B. Tech. (ME) III SEMISTER
ME - 214
MANUFACTURING SCIENCE

Course code	PCC				
Category	Professional Core Course				
Course title	**Manufacturing Science**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Internal marks = 30
	3	**0**	**-**	**3**	External Marks = 70

UNIT-I

Introduction to Casting: Molding Sands, Properties of sands, Testing of Sand properties and their improvements. Types of patterns and pattern materials, Pattern allowances. Core sands, core sand properties and core making processes. Machine Moulding techniques. Riser and Riser size estimation Chvorinov and Caine's rules. Types gates and components of gating system. Theory of solidification. Introduction to Furnaces: Cupola, Arc and Induction.

UNIT-II

Special Casting Processes: Shell Mould Casting, Co2 Casting, Investment Casting, Gravity and Pressure Die Casting, Centrifugal Casting and Continuous Casting. Cleaning of Castings, Casting defects and their Causes. Processing of Plastics: Blow molding, Injection molding, Reaction injection molding, Rotational molding and Extrusion. Manufacturing of Composites: Hand lay-up, Filament winding, Compression molding, Resin infusion molding

UNIT-III

Sheet Metal Working: Geometry of Punch and Die for Blanking/Piercing operations, Cup Drawing, Strip Layout, Force Calculations. Metal spinning. High Energy Rate Forming: Explosive forming, Magnetic forming, Electro-hydraulic forming and Rubber pad forming.

UNIT - IV

Bulk Deformation Processes: Simple Estimation of Forces in Forging, Rolling, Rod Drawing and Extrusion. Hydrostatic Extrusion. Powder Metallurgy: Powder production methods, steps in powder metallurgy processes, cold and hot isostatic pressing, typical industrial applications.

UNIT-V

Gas Welding: Oxy-Acetylene Welding-Basic set up, Welding and Cutting Torches, Types of Flames. Arc Welding: Schematics of SMAW, GTAW, GMAW, PAW, SAW, LBW and EBW, Electrode Coatings and Electrode Specifications. Resistance Welding: Spot, Seam, Projection and butt welding, Flash welding. Solid State Welding: Pressure Welding, Ultrasonic Welding, Friction welding and Explosive welding. Basics of soldering and brazing.

TEXT BOOKS:

1. P.N.Rao, "Manufacturing Technology," Vol. 1, Tata McGraw Hill Publ., 3nd Ed., 2011.
2. Amitabh Ghosh & Mallick, "Manufacturing Science", Assoc. East west Press Pvt. Ltd. 4th Ed., 2011.

REFERENCE BOOKS:

1. Serope Kalpakjian, "Manufacturing Engineering and Technology", Addison, Wesley Publishing Company, 2006
2. Kaushish J.P, "Manufacturing Processes", PHI Learning Pvt. Ltd., 2nd, 2010

Faculty of Engineering &Technology
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B. Tech. (ME) III SEMISTER
ME – 215L
MATERIAL TESTING AND METALLURGY LAB

Course code	PCC				
Category	Professional Core Course				
Course title	Material Testing and Metallurgy Lab				
Scheme and Credits	L	T	P	Credits	Internal marks = 25
	-	-	3	1.5	External Marks = 50

List of Experiments in Mechanics of solids lab:

1. Preparation and study of Crystal models.
2. To study the stress -strain characteristics of (a) Mild Steel and (b) Tor steel by conducting tension test on U.T.M
3. Impact testing- Izod and Charpy
4. Hardness testing on various materials (a) Steel (b) Brass (c) Aluminium (d) Copper
5. Determination of Young's modulus by deflection method
6. To find the Modulus of rigidity of the material of a spring by conducting Compression and Tension test.

List of Experiments in Metallurgy lab:

1. Study of Crystal Structures, Metallurgical Microscope, Iron-Iron Carbide diagram
2. Sample Preparation techniques for Metallographic Analysis
3. Grain size measurement
4. Metallographic Study of Pure Iron, Low carbon steel
5. Metallographic Study of Medium carbon steel
6. Metallographic Study of Hyper Eutectoid steel
7. Metallographic Study of Wrought iron
8. Metallographic Study of Grey cast iron
9. Metallographic Study of White cast iron
10. Metallographic Study of Black heart/ White heart Malleable cast iron
11. Metallographic Study of Copper alloy
12. Metallographic Study of Aluminium alloy
13. Determination of hardenability by Jominy Quench Test
14. Study of microstructure after hardening, normalizing and annealing of steel specimen.

Note: Any ten experiments can be conducted

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B. Tech. (ME) III SEMISTER
ME – 216L
MANUFACTURING SCIENCE LAB

Course code	PCC				
Category	Professional Core Course				
Course title	**MANUFACTURING SCIENCE LAB**				
Scheme and Credits	L	T	P	Credits	Internal marks = 25
	-	-	3	1.5	External Marks = 50

LIST OF EXPERIMENTS:

Foundry:

1. Study of foundry setup, equipment and the displayed charts with particular attention to moulding machines, sand muller, shell moulding machine & centrifugal casting machine.
2. Mixing and preparation of molding sand samples, Testing of greensand properties.
3. Preparation of molding sand aggregate and simple moulds of greensand complete with sprues,
4. gates and risers.
5. Exercise of melting and casting involving prepared moulds, aluminium metal and crucible furnace. Cleaning of castings, study of the features of the final casting, its features and any visible defects.
6. Experimental Study of blow moulding.
7. Experimental study of centrifugal casting

Welding:

1. Study of the welding equipment and tools related to Arc, gas and resistance welding & displayed charts.
2. Practice of Arc, Resistance Spot, Resistance Butt and Gas welding. Identification of different types of gas flames.

3. Experimental study of
   (a) Electrode characteristics of SMAW.
   (b) Arc length and welding speed on bead characteristics.
   (c) Welding current on bead penetration.
4. Determination of weld characteristics using DC and AC power sources.
5. TIG and MIG welding process - study and exercises.

Forming:

1. Study of the forming equipment: Different types of mechanical presses and hammers, Metal spinning Lathe.
2. Conventional extrusion of metals.
3. Study of sheet metalworking dies and sheet metal working with existing dies.
4. Testing of metals: Fatigue tests. Testing of sheet metals for formability by using Erichson cupping test.
5. Study of HERF processes. Sheet metal forming with water hammer forming equipment

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B. Tech. (ME) III SEMISTER
ESC – 106
APPLIED ELECTRONICS

Course code	ESC				
Category	Engineering Science Course				
Course title	**APPLIED ELECTRONICS**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Internal marks = 30
	3	**0**	**-**	**3**	External Marks = 70

UNIT-I

Characteristics of PN Junction: Half wave rectifier, Full wave rectifier, filters, ripple, regulation, TIF and efficiency, Zener diode and Zener diode regulators. CRT construction and CRO applications

UNIT-II

Bipolar and Field Effect Transistors : Biasing FET , small signal model, h-parameter equivalent circuits, basic amplifier circuits-CB,CE,CC configurations of BJT and CG,CS and CD configurations of FETs, RC-coupled amplifier and its frequency response.

UNIT-III

Feedback Concepts: Types of negative feedback-modification of gain, bandwidth, input and output impedances-applications; Oscillators: RC phase shift, Wien bridge, LC and Crystal Oscillators.

UNIT-IV

Operational Amplifier: Characteristics, applications, Differential amplifiers, logic gate circuits-Introduction to Digital Systems-AND,NAND,NOR,XOR gates, Binary half wave adder, full adder, Multi-vibrators-Bi-stable, Mono-stable and Astable Multi-vibrators (Qualitative treatment only),Schmitt trigger.

UNIT-V

Data Acquisition Systems: Construction and Operation of transducers-Strain gauge LVDT, Thermocouple, Instrumentation Systems, Magnetic tape recorders, FM recording, Digital recording, Digital to Analog and Analog to Digital conversions.

TEXT BOOKS:

1. Robert Boylestad L. and Louis Nashelsky, *Electronic Devices and Circuit Theory*, Prentice Hall of India, 2007.

2. Helfrick D and David Cooper, *Modern Electronic Instrumentation and Measurements Techniques*, 1st edition, Prentice Hall of India, 2006.

3. Salivahanan, Suresh Kumar and Vallavaraj, *Electronic Devices and Circuits*, 2nd edition, Tata McGraw-Hill, 2010.

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B. Tech. (ME) III SEMISTER
ESC – 106L
APPLIED ELECTRONICS -LAB

Course code	ESC				
Category	Engineering Science Course				
Course title	**APPLIED ELECTRONICS LAB**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Internal marks = 25
	0	**0**	**2**	**1**	External Marks = 50

List of Experiments:

1. CRO-Applications, Measurements of R, L and C using LCR meter, Color code method and soldering practice.
2. Characteristics of Semiconductors diode (Ge, Si and Zener)
3. Static Characteristics of BJT-Common Emitter
4. Static Characteristics of BJT-Common Base
5. Static Characteristics of FET
6. RC-Phase Shift Oscillator
7. Hartley and Colpitts Oscillators
8. Common Emitter Amplifier
9. Astable Multivibrator
10. Full-wave rectifier with and without filters using BJT
11. Operational Amplifier Applications
12. Strain Guage Measurement
13. Analog-to-Digital and Digital to Analog Converters