SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering
Electronics & Telecommunication (2020 – 2021)

Program: MBA Tech. (EXTC)				**Semester: III**	
Course: Mathematics-III				**Code:** MBET03009	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100 in Question Paper)**
3	0	1	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite:

Knowledge of Integration, Differential Equation, Periodic function, Even and odd Function, Beta-Gamma Function, Circular Function and Trigonometric series.

Objectives:

1. To provide an understanding of Laplace transform and its applications, Fourier series, Fourier Transform, Z-transform.
2. To provide students with mathematics fundamentals necessary to formulate, solve and analyses complex engineering problem

Outcomes:

After completion of the course, students would be able to :

1. Solve problems using Laplace transform, Fourier series, Fourier Transform, Z -transform.
2. Analyze the concept of Laplace transform, Fourier series, Fourier Transform, Z -transform.
3. Apply the techniques of Laplace transform, Fourier series, Fourier Transform and Z -transform to engineering problems.

Detailed Syllabus:

Unit	**Description**	**Duration**
1	**Laplace transformation:** Definition of Laplace transform, Laplace transform of 1, e^{at},	**13**

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	$\sin at$, $\cos at$, $\sinh at$, $\cosh at$, t^n, Properties of Laplace transform: Linearity property, First and second shifting theorems of Laplace transform, Change of scale property, $L\{t^n f(t)\}$, $L\left\{\frac{f(t)}{t}\right\}$, $L\{f^n(t)\}$, $L\left\{\int_0^t f(u)\,du\right\}$, Evaluation of Inverse Laplace transform by partial fraction, Convolution theorem, Laplace transforms of Periodic functions, Unit step functions, Dirac delta functions. Applications: to solve initial and boundary value problems involving ordinary differential equations.	
2	**Fourier series:** Orthogonality and Orthonormality, Periodic function, Trigonometric Series, Dirichlet's conditions, Euler's formulae (Derivative of Fourier coefficients a_0, a_n, b_n is not expected), Fourier Series of Functions for the interval $[\alpha, \alpha+2\pi]$ and $[\alpha, \alpha+2c]$, Functions having points of discontinuity, Even and odd functions, half range sine and cosine expansions, Parseval's identities. Complex form of Fourier series, Fourier integral theorem, Fourier sine and cosine integral.	**11**
3	**Fourier Transform:** Fourier Transform, Fourier Sine Transform, Fourier Cosine Transform, Properties of Fourier Transform (Linearity property, Change of scale property, Shifting property), Inverse Fourier Transform, Inverse Fourier Sine Transform, Inverse Fourier Cosine Transform, Finite Fourier Transform. Application: Fourier transform to solve differential equations.	**9**
4	***Z*-transforms:** Introduction, Sequences, Representation of sequences, Basic operators on Sequences, *Z*-transforms, Properties of *Z*-Transforms, Change of scale, Shifting Properties, Inverse *Z*-transform, Solution of Difference equations, Multiplication by *K*, Division by *K*, Initial value, Final value, Partial sum, Convolution, Convolution Property of Casual Sequence,	**12**

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	Transform of important sequences, Inverse of Z-transform by division, binomial expansion and partial fraction, Inverse by residue Method, Solution of Difference equation.	
	Total	**45**

Text Books:

1. B. V. Ramana (2017), "Higher Engineering Mathematics", *McGraw Hill Education*, *1st Edition.*

Reference Books:

1. G. B. Thomas (2014), "Calculus", *Pearson, 13th Edition.*
2. Erwin Kreyszig (2017), "Advanced Engineering Mathematics", *Wiley India, 10th Edition.*
3. B. S. Grewal (2017), Higher Engineering Mathematics, *Khanna Publishers, 44th Edition.*

Details of Internal Continuous Assessment (ICA)
Test Marks : 20
Term Work Marks : 30
Term Work:

1. At least ten Tutorials based on the entire syllabus duly recorded and graded.
2. Tutorials/ Assignments/ Viva-voce/ Quiz/ Tutorial test/ Seminar/Presentation

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Program: MBA Tech. (EXTC)				**Semester : III**	
Course : Electronic Devices				**Code :** MBET03010	
Teaching Scheme				**Evaluation Scheme**	
Lecture Hours per week	**Practical Hours per week**	**Tutorial Hours per week**	**Credit**	**Theory (3 Hrs, 100 Marks)**	**Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)**
3	2	0	4	Scaled to 50 Marks	Scaled to 50 Marks

Pre-requisite: Engineering Physics

Objectives:

1. To understand the construction, working principle, characteristics and simple applications of basic electronic devices.
2. To understand the application of these devices in making advanced circuits like amplifiers and oscillators.

Outcomes:

After the successful completion of this course, the student will be able to

1. Understand construction and characteristics of various types of diodes and illustrate simple circuits with diodes.
2. Understand bipolar junction transistor (BJT) and Field Effect Transistor (FET), their modes of operation and analyse their applications.
3. Analyse different types of amplifier and oscillator circuits.
4. Understand the basic concepts of Operational amplifier.

Detailed Syllabus:

Unit	**Description**	**Duration**
1.	Diodes and Applications covering: Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications, Schottky diode, solar cell;	**08**

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2.	Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-Vcharacteristics, and small signal switching models;	**08**
3.	Bipolar Junction Transistor covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, I-V characteristics, Ebers-Moll Model, Voltage Divider Bias Configuration;	**07**
4.	Field Effect Transistor covering, Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits; MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor;	**07**
5.	Transistor Amplifiers and Oscillators covering, Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;	**09**
6.	Operational Amplifiers covering, Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; calculation of differential gain, common mode gain, CMRR and ICMR.Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground;OP-AMP Design of gain stages and output stages, compensation.	**06**
	Total	**45**

Text Books:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.
2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education

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3. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley & Sons, 2006.
4. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.

Reference Books:

1. Donald Schilling & Charles Belove, "Electronic Circuits Discrete and Integrated", McGraw Hill International, 3rd edition, 1989.
2. Martin Roden, Gordon Carpenter, William Wieserman, "Electronic Design", Shroff.Publishers, 4th edition, 2002.
3. Robert Boylestad& Louis Nashelsky, "Electronic Devices & Circuit Theory", Pearson Education India - 9th Edition, 2007.
4. B.L. Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co., 2nd Edition, 2004.

Details of Internal Continuous Assessment (ICA)
Test Marks : 20
Term Work Marks : 30
Term Work:

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.
2. Experiments covering the following topics
   - PN Junction Diode Characteristics
   - Zener diode characteristics and load and line regulation
   - Rectifiers and filters
   - BJT Characteristics and biasing methods
   - FET Characteristics and biasing methods
   - BJT applications- Amplifier and switch
   - OP-AMP parameter measurements
   - Differential Amplifier
   - Oscillators: High and low frequency
3. Lab Experiments/Tutorials/Assignments/Viva-voce/ Quiz/Lab Exam/ Seminar/Presentation

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Program: MBA Tech. (EXTC)				**Semester : III**	
Course : Digital System Design				**Code :** MBET03011	
Teaching Scheme				**Evaluation Scheme**	
Lecture Hours per week	**Practical Hours per week**	**Tutorial Hours per week**	**Credit**	**Theory (3 Hrs, 100 Marks)**	**Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)**
3	2	0	4	Scaled to 50 Marks	Scaled to 50 Marks

Pre-requisite: NIL

Objectives:

1. To provide knowledge of digital logic & digital system as well as their applications in technical field.
2. To provide knowledge of basic building blocks and their working.
3. To provide knowledge of designing the digital logic circuit using basic building blocks and necessary techniques which is required in computer hardware design.

Outcomes:

After the successful completion of this course, the student will be able to

1. Understand concept of digital system and logic simplification.
2. Apply HDL & appropriate EDA tools for digital logic circuit design.
3. Design and analyze combinational and sequential circuits.
4. Understand different logic families and semiconductor memories.

Detailed Syllabus:

Unit	Description	Duration
1.	**Introduction To Digital Systems and logic simplification:** Number Systems: binary, octal, hexadecimal, BCD. Conversion from one system to another, Binary Subtraction using 1's and 2's Complement method. Weighted codes: BCD and binary, non-weighted codes: grey and excess 3, conversion from one code to another. Logic gates and implementation of digital logic using universal gates, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 4 variables	**10**

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2.	**Introduction to VHDL:** VLSI Design flow: Design entry, Schematic, different modelling styles in VHDL: Dataflow, Behavioural and Structural Modelling. Data types and objects, Synthesis and Simulation of any digital logic	**06**
3.	**Combinational logic circuit and its implementation:** Combinational circuits : Adders, Subtractors (half and full), BCD adder, Serial and Parallel adder, ALU, Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Design of digital logic using MUX. VHDL codes for combinational digital circuits.	**12**
4.	**Sequential Logic Circuits:** Flip-flops: SR, T, D, JK, master slave JK, converting one flip-flop to another. Shift registers, Synchronous and Asynchronous (Ripple) Counters and its designing. Ring counter, Johnson counter, pseudo random binary sequence generator. Finite state machines: mealy and moore circuits, Design of synchronous FSM, VHDL codes for sequential digital circuits.	**12**
5.	**Logic Families and Semiconductor Memories:** TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, ECL, CMOS families, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.	**05**
	Total	**45**

Text Books:

1. Morris Mano, Digital Design, PHI, 4th edition, 2008.

Reference Books:

1. R.P Jain, Digital Electronics and Microprocessors, Tata McGraw-Hill, 25th reprint 2007.
2. Roth and John: Principles of Digital Systems Design, Ceneage Learning, Sixth Indian Reprint 2011.
3. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.

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Details of Internal Continuous Assessment (ICA)
Test Marks : 20
Term Work Marks : 30
Term Work:

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.
2. Experiments covering the following topics
   - Logic gates and universal gates
   - De-Morgan's theorem
   - Codes and code conversion
   - Combinational circuits
   - Sequential circuits
   - Study of logic families and Semiconductor Memories
   - VHDL programming of combinational and sequential circuit
3. Lab Experiments/ Tutorials/ Assignments/ Viva-voce/ Quiz/ Lab Exam/ Seminar/Presentation

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Program: MBA Tech. (EXTC)				**Semester : III**	
Course : Signals and Systems				**Code :** MBET03012	
Teaching Scheme				**Evaluation Scheme**	
Lecture Hours per week	**Practical Hours per week**	**Tutorial Hours per week**	**Credit**	**Theory (3 Hrs, 100 Marks)**	**Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)**
3	2	0	4	Scaled to 50 Marks	Scaled to 50 Marks

Pre-requisite: Engineering Mathematics

Objectives:

1. To provide knowledge of analog domain signals and systems for time and frequency domain analysis.
2. To study various continuous and discrete time transforms.

Outcomes:

After the successful completion of this course, the student will be able to

1. Define and identify various types of signals and systems.
2. Apply mathematical operations to analyze signals and systems.
3. Apply various mathematical transforms for continuous time signal and systems.
4. Use various transforms to analyze discrete time signal and systems.

Detailed Syllabus:

Unit	Description	Duration
1.	**Introduction to Signals and Systems:** Introduction to Signals and Systems, Classification of signals, Elementary signals: analog and discrete time, Basic operation of signals.	**04**
2.	**Time domain representation for linear time invariant systems (analog & discrete):** Classification of systems, Convolution of infinite and finite time continuous signals and discrete time signals, Impulse, step response for first and second order LTI systems	**06**
3.	**Fourier Series for continuous time and discrete time signals:** Representation of signals in terms of orthogonal and orthonormal functions, Dirichlet Conditions, Gibb's Phenomenon, Fourier	**07**

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	series representation of continuous and discrete time signals.	
4.	**Fourier Transform for continuous time signals:** Limitations of Fourier Series, Introduction to Fourier transform, properties, Fourier transform of periodic signal, Relation between Fourier and Laplace Transform, Frequency response.	**06**
5.	**Laplace transforms:** Limitations of Fourier transform, Introduction to Laplace transform, ROC and properties, Application of Laplace Transform in electrical circuit, Laplace Transform of elementary signals, Unilateral Laplace transform, Inverse Laplace transform, Using Laplace Transform with or without initial conditions.	**12**
6.	**Z - transform :** Introduction to Z transform, Z transform of elementary signals, ROC, Properties of Z transform, Inverse of Z transform using Partial Fraction and long division rule, Solution of difference equation, Introduction to Unilateral Z transform.	**10**
	Total	**45**

Text Books:

1. Tarun Kumar Rawat, Signals and Systems, Oxford University Press, July-2010.
2. Nagoor Kani , Signals and Systems, McGraw-Hill publication, 1st Edition, March-2010.

Reference Books:

1. Oppenheim & Willsky, Signal and Systems, Prentice Hall of India publication, 2nd edition, 2008.
2. Simon Haykin & Barry van veen, Signal and Systems, John Wiley publication. 2nd edition, 2008.

Details of Internal Continuous Assessment (ICA)
Test Marks : 20
Term Work Marks : 30
Term Work:

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.

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2. Experiments covering the following topics
   - Plotting of elementary signals like sine, cos and impulse
   - Find whether given signal is even or odd
   - Find whether given signal is periodic or aperiodic
   - Evaluate convolution integral
   - Evaluate convolution sum
   - Compute Laplace transform of the continuous time signal
   - Compute and plot poles and zeros of the system
   - Find whether given system is stable or unstable
   - Evaluate CTFT of the given signal
   - Self-Experiment (Project)
3. Lab Experiments/ Tutorials/ Assignments/ Viva-voce/ Quiz/ Lab Exam/ Seminar/Presentation

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Program: MBA Tech. (EXTC)				**Semester : III**	
Course : Circuit and Network Theory				**Code :** MBET03013	
Teaching Scheme				**Evaluation Scheme**	
Lecture Hours per week	**Practical Hours per week**	**Tutorial Hours per week**	**Credit**	**Theory (3 Hrs, 100 Marks)**	**Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)**
3	0	0	3	Scaled to 50 Marks	Scaled to 50 Marks

Pre-requisite: Knowledge of Basic Electrical Engineering

Objectives:

1. To provide knowledge of basic fundamentals of Electrical & Electronics network analysis and synthesis.
2. To expose students to simulation tools for circuit analysis.
3. To analyse and synthesize two port networks.

Outcomes:

After the successful completion of this course, the student will be able to

1. Apply knowledge of basic electrical engineering to analyze ac and dc circuits.
2. Apply knowledge of mathematics to evaluate the steady state and transient responses of electrical circuits.
3. Know different parameters of two-port networks and compute network parameters.
4. Synthesize L-C, R-C and R-L circuits.

Detailed Syllabus:

Unit	**Description**	**Duration**
1.	**Mesh & Node Analysis** Mesh & Node Analysis of circuits with independent & dependent AC and DC sources.	**05**
2.	**Network Theorems** Linearity, Superposition, Current & Voltage Source Transformation, Thevenin's & Norton's Theorem, Maximum power transfer theorem, Compensation and Tellegen's theorem – as applied with independent & dependent AC and DC sources.	**09**

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3.	**Circuit Analysis** Introduction to Graph Theory. Tree, link currents, branch voltages, cut set & tie set. Mesh & Node Analysis, Duality.	**04**
4.	**Transient Analysis of Circuits using Classical Technique** First & second Order Differential equations for Evaluation & analysis of Transient and Steady state responses, initial conditions.	**05**
5.	**Transient and steady state response of circuits using Laplace Transform** Circuit analysis using Laplace Transform. Transfer function, Concept of poles and zeros of immitance functions and their properties, sinusoidal response from pole-zero locations	**05**
6.	**Network functions and Two - port Networks** Concept of two- port network. Driving point & Transfer Functions, Open Circuit impedance (Z) parameters, Short Circuit admittance (Y) parameters, Transmission (ABCD) parameters. Inverse Transmission (A'B'C'D') parameters. Hybrid (h) parameters. Inter Relationships of different parameters. Interconnections of two – port networks. T & Pi representation. Terminated two - port networks. Introduction to band pass, low pass, high pass and band reject filters	**10**
7.	**Network Synthesis** Positive real functions, Properties of Positive real functions, Testing Positive real functions. Driving Point functions, Testing driving point functions. Properties of Hurwitz polynomials, Residue computations, Even & odd functions, Driving Point Synthesis with L-C, R-C and R-L circuits.	**07**
	Total	**45**

Text Books:

1. William. H. Hayt, Jack E. Kemmerly & Steven M. Durbin, 'Engineering Circuit Analysis', McGraw Hill International, 6th edition, 2002.

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2. M. E. Van Valkenburg, 'Network Analysis', Prentice Hall of India, 3rd edition, 2006.

Reference Books:

1. A. Sudhakar & S. P. Shyammohan, 'Circuits and Networks', Tata McGraw Hill, thirteenth reprint, 2000.
2. Artice M. Davis, 'Linear Circuit Analysis', Thomson Asia Pte. Ltd., Singapore, first edition, 2001
3. Raymond A. DeCarlo & Pen-Min Lin, 'Linear Circuit Analysis', Oxford University Press, second edition, 2001.
4. Ravish Singh 'Electrical Networks' Tata Mc Graw hill publication, 2009.

Details of Internal Continuous Assessment (ICA)
Test Marks : 20
Term Work Marks : 30
Term Work:

1. Assignments/ Viva-voce/ Quiz/ Seminar/Presentation

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Program: MBA Tech (EXTC)				**Semester : III**	
Course : Electromagnetic Field Theory				**Code :** MBET03014	
Teaching Scheme				**Evaluation Scheme**	
Lecture Hours per week	**Practical Hours per week**	**Tutorial Hours per week**	**Credit**	**Theory (3 Hrs, 100 Marks)**	**Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)**
3	0	0	3	Scaled to 50 Marks	Scaled to 50 Marks

Pre-requisite: Knowledge of Basic Electrical Engineering and Mathematics.

Objectives:

1. To introduce concepts of electric and magnetic fields and propagation of uniform plane waves.
2. To impart knowledge on electrostatics, electrical potential, energy density and their applications.
3. To understand concepts of magneto statics, magnetic flux density and relations between field due to time-varying situations.
4. To introduce the concept of transmission lines.

Outcomes:

After successful completion of this course, students should be able to

1. Apply vector calculus concepts to understand behavior of static electric field.
2. Apply vector calculus concepts to understand behavior of static magnetic field.
3. Analyze Maxwell's equation in different forms (differential and integral) and apply them to uniform plane wave propagation.
4. Understand the concept of voltage, current impedance, and power along two-conductor transmission lines using the solution of the wave equation and Smith chart.

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Detailed Syllabus:		
Unit	**Description**	**Duration**
1.	**Review of Vector Calculus:** Vector Field, Rectangular, Cylindrical and Spherical Coordinate systems.	**04**
2.	**Coulomb's law and electric field intensity:** Coulomb's law, electric field intensity, calculation of electric field intensity for various charge distributions. **Electric flux density and Gauss's law:** Electric flux density, Gauss's law, vector operator and divergence theorem.	**08**
3.	**Energy , potential and Capacitance:** Energy expended in moving a point charge in an electric field, line integral, potential and potential difference, calculations of electric field of both point charge and system of charges, potential gradient, dipole, energy density, Capacitance, calculation of capacitance of various configurations. Current and current density continuity of current, conductor properties, dielectric material and properties, method of images.	**08**
4.	**Steady magnetic field:** Biot – Savart law, Ampere's circuital law, curl of H, Stoke's theorem, magnetic flux and flux density.	**04**
5.	**Time varying fields and Maxwell's equations:** Faraday's law concept of displacement currents, Maxwell's equations in point form, Maxwell's equations in integral form, boundary conditions and significance of Maxwell's equations.	**04**

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6.	**Uniform Plane waves:** Uniform plane waves in time domain in free space, Sinusoidally time varying uniform plane waves in free space, wave equation in dielectrics and conductors.	**04**
7.	**Poynting vector and flow of power:** Poynting vector and flow of power: Poynting theorem, power flow for a plane wave, Poynting loss in a plane conductor.	**03**
8.	**Introduction to Transmission Lines:** Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.	**10**
	Total	**45**

Text Books:

1. Hayt & Buck, Engineering Electromagnetics, Tata McGraw-Hill, 8h Edition, 2011.
2. Matthew Sadiku, Elements of Electromagnetism, Oxford University Press, 5th Edition, 2010.

Reference Books:

1. Edward C. Jordan, Keith G Balmann, Electromagnetic Waves and radiating systems, Prentice Hall of India, 2nd edition, 2011.
2. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, Pearson Education, 6th edition, 2006.
3. Edminister J.A, Electromagnetics, Tata McGraw-Hill, 2nd edition, 2006.

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Details of Internal Continuous Assessment (ICA)
Test Marks : 20
Term Work Marks : 30
Term Work:

1. Assignments/ Viva-voce/ Quiz/ Seminar/Presentation

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SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering
Electronics & Telecommunication Engineering (2020 – 2021)

Program: MBA. Tech. (EXTC)				**Semester: V**	
Course: Elements of Biology				**Code:** MBET05007	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- 100 in Question Paper)**
3	0	1	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Fundamental Knowledge of physics, chemistry and mathematics.

Objectives:

1. To provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers.
2. To encourage engineering students to think about solving biological problems with engineering tools.

Course Outcomes:

After completion of the course, students would be able to:

1. Convey that all forms of life have the same building blocks and yet the manifestations are diverse.
2. Identify DNA as a genetic material in the molecular basis of information transfer.
3. Classify enzymes and distinguish between different mechanisms of enzyme action.
4. Apply thermodynamic principles to biological systems.
5. Identify and classify microorganisms.

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1.	**Introduction** Convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major	**3**

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	discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	
2.	**Classification** Convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus	**6**
3.	**Genetics** Convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	**6**
4.	**Biomolecules** Convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids	**5**

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	and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	
5.	**Enzymes** Convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	**5**
6.	**Information Transfer** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	**6**
7.	**Macromolecular analysis** How to analyses biological processes at the reductionistic level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	**5**
8.	**Metabolism** The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy Charge.	**5**
9.	**Microbiology** Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy.	**4**

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	Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	
	Total	**45**

Text Books:

1. Arthur T. Johnson, ''Biology For Engineers'' CRC Press Taylor & Francis group, 2011.
2. Prescott, L.M J.P. Harley and C.A. Klein, "Microbiology", 7th edition McGraw-Hill Higher Education, 2008.

Reference Books:

1. Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B., "Biology: A global approach", Pearson Education Ltd
2. Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., "Outlines of Biochemistry", John Wiley and Sons
3. Nelson, D. L.; and Cox, M. M.W.H. Freeman, Principles of Biochemistry, 5th Edition.

Term Work: As per institution norms.

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Program: MBA. Tech. (EXTC)				**Semester : V**	
Course : Analog and Digital Communication				**Code :** MBET05008	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50
Pre-requisite: Signals and Systems, Probability and Stochastic Processes					

Objectives:

1. To teach various types of Analog & digital modulation and demodulation techniques.
2. To recognise concept of baseband shaping for data transmission and detection.
3. Understand various coding and decoding techniques.
4. To learn basic concepts spread spectrum techniques and their applications.

Outcomes:

After completion of the course, students would be able to:

1. Evaluate the principles and concepts of different analog & digital modulation techniques.
2. Apply different base band shaping techniques for data transmission and detection.
3. Analyze different algorithms for source and error control coding.
4. Understand the concepts and applications of spread spectrum modulation.

Detailed Syllabus:

Unit	**Description**	**Duration**
1	**Introduction to Electronic communications:** Elements of a communication system, modulation and demodulation, Electromagnetic frequency spectrum, Principles of Amplitude Modulation systems- DSB, SSB and VSB modulations. Angle modulation: Frequency modulation (FM), Phase	**07**

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	modulation (PM), FM noise triangle, pre-emphasis and de-emphasis.	
2	**Analog Pulse modulation and Multiplexing Techniques:** Sampling theorem for low- pass and band–pass signals- proof with spectrum, aliasing, Sampling techniques. **Pulse modulation:** Classification of Pulse modulation**,** Generation and detection of**:** Pulse amplitude modulation (PAM), Pulse width modulation (PWM), and Pulse position modulation (PPM). **Multiplexing:** Principles of Time division multiplexing (TDM), Frequency division multiplexing (FDM).	**07**
3	**Waveform coding techniques:** Model of digital communication system, Quantization and Encoding, Pulse Code Modulation (PCM) transmitter and receiver, Differential PCM (DPCM) transmitter and receiver, Delta Modulation (DM) transmitter and receiver, quantization noise and slope overload distortion, Adaptive delta modulation (ADM) transmitter and receiver, Discrete PAM signals: Line coding techniques: Unipolar, Polar and bipolar.	**07**
4	**Base Band Shaping for data Transmission and detection:** GRAM-SCHMIDT orthogonalization procedure, Geometric Interpretation of signal, Power Spectra of discrete PAM, Inter symbol Interference (ISI), Eye pattern. **Baseband Detection:** Detection of binary signals, Maximum likely hood detector, Probability of error, Correlation receiver, Matched filter receiver.	**06**

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5	**Digital Modulation Techniques:** Digital Modulation formats, Coherent Binary modulation techniques: FSK and PSK , Coherent Quadrature modulation techniques: Quadriphase-shift Keying, Minimum Shift Keying.	**07**
6	**Source coding and Error Control Coding:** Uncertainty, Information and Entropy, Properties of Entropy, Source coding Theorem, Huffman coding. Channel Coding Theorem, Linear Block codes, Encoder and Decoder using Shift Register Method for Cyclic codes.	**07**
7	**Spread Spectrum Modulation:** Pseudo noise sequences, A Notion of Spread spectrum, Direct sequence spread coherent binary phase shift keying, Frequency hop spread spectrum: Slow Frequency hopping and fast frequency hopping, applications.	**04**
	Total	**45**

Text Books:

1. Wayne Tomasi, Electronics Communication systems, Fundamentals through advanced, Pearson Education, 5th edition, 2009.
2. Simon Haykin, Digital Communication, Wiley India Edition, Reprint 2010.
3. Herbert Taub, Donald L Schilling, Goutam Saha, Principles of Communication systems, 4th Edition, McGraw Hill, July 2013.

Reference Books:

1. Simon Haykin, Digital Communication systems, first edition, John Wiley & Sons, 2014.
2. John G. Proakis, Masoud Salehi, Digital Communications, 5th Edition, McGraw Hill, September 2018.
3. G. Kennedy, B. Davis, SRM Prasanna, Kennedy's Electronic Communication System (SIE), 6th edition, McGraw Hill Education private ltd., 2017.

Details of Internal Continuous Assessment (ICA)

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Test Marks: 20
Term Work Marks: 30

Details of Term Work:
Term work should consist of the following

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.
2. Experiments covering the following topics:
    - Amplitude Modulation
    - Frequency Modulation
    - SSB and DSBSC Modulation
    - PAM, PWM and PPM
    - TDM and FDM
    - Pre-emphasis & De-emphasis Circuits in FM applications.
    - Verification of Sampling Theorem
    - Pulse Code Modulation
    - Delta Modulation
    - Line Coding Techniques
    - Cyclic Code and Linear Block Code
    - ASK, FSK and PSK
    - DPSK and QPSK
3. Lab Experiments/Tutorials/Assignments/Viva-voice/Quiz/Lab Exam/Seminar/Presentation.

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Program: MBA. Tech. (EXTC)				**Semester : V**	
Course : Discrete Time Signal Processing				**Code :** MBET05009	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Knowledge of Signals and Systems

Objectives:

1. To introduce different types of linear discrete time systems.
2. To analyze techniques to transform time domain discrete time signal representation to frequency domain representation.
3. To design discrete time filters.

Outcomes:

After the successful completion of this course, the student will be able to

1. Analyze Finite Impulse Response and Infinite Impulse Response systems.
2. Apply various transforms on Discrete Time signals.
3. Design Finite Impulse Response and Infinite Impulse response filters.
4. Implement the structures of discrete time filters and their quantization effects.

Detailed Syllabus:

Unit	Description	Duration
1	**Analysis of LTI systems:** Frequency response of LTI systems, pole zero plots, phase and delay distortion, All pass systems, minimum, maximum mixed phase systems, Review of low pass, high pass, band pass filters, digital resonator, comb filters, notch filters & digital sinusoidal oscillators	**08**
2	**Transforms for Discrete Time Signals:** Discrete Fourier transform: DFT and its properties, multiplication of two DFTs- the circular convolution, additional DFT properties,	**07**

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	use of DFT in linear filtering, overlap-save and overlap-add method	
3	**Fast Fourier transform** Radix 2, 4 and 8 point FFT using radix-2,application of FFT algorithm, Decimation in Time FFT, Decimation-in-Frequency FFT, Inverse FFT , Comparison between DFT and FFT	**06**
4	**Design of FIR filters:** Linear phase filters, causal generalized linear phase system, symmetric, anti-symmetric filters, FIR Filter Design: Frequency sampling method, Windowing method of FIR design, Types of windows(Rectangular, Hamming, Hanning and Blackman)	**06**
5	**Design of IIR filters:** Butterworth filter, Introduction to Chebyshev filters. Design IIR filter using Bilinear transformation Frequency transformation low pass to high pass, band pass, band reject filters	**07**
6	**Structures for discrete time systems:** FIR structures (direct form, cascade form, frequency sampling and lattice); structures for linear phase filters. Structures for IIR systems, direct form-I, Direct form-II, Transposed structures. Analysis of cascaded and parallel IIR structures and FIR structures.	**07**
7	**Amplitude quantization:** Effect of coefficient quantization in IIR and FIR systems, effect of round off noise in digital filters, quantization errors.	**04**
	Total	**45**

Text Books:

1. John Proakis, Digital signal processing, Pearson Education , 4th edition, 2014.
2. Tarun Kumar Rawat, Digital Signal Processing, Oxford University Press, December-2015

Reference Books:

1. Monson H. Hays, Schaums Outline of Digital Signal Processing, McGraw-Hill, 2nd edition, 2011.

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2. Maurice Bellanger, Digital Processing of signals, John Wiley Publication, 3rd edition, 2000.

Details of Internal Continuous Assessment (ICA)

Test Marks : 20

Term Work Marks : 30

Term Work:

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.
2. Experiments covering the following topics
    - Generation of sinusoidal signal of given frequency and sampling frequency.
    - Frequency response and pole zero plot of IIR/FIR - LPF, HPF, BPF and BRF.
    - Frequency response and pole zero plot of digital resonator, comb filters, notch filters
    - N-Point DFT and IDFT.
    - Circular convolution and linear convolution.
    - Frequency extraction of audio file using digital filtering.
    - Designing Butterworth filter.
    - Designing chebyshev type-I and II filters.
    - Designing FIR filters using windowing technique.

3. Lab Experiments/Tutorials/Assignments/Viva-voce/ Quiz/Lab Exam/ Seminar/Presentation

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Program: MBA. Tech. (EXTC)				**Semester : V**	
Course : Statistical Methods and Analysis				**Code :** MBET05010	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
3	0	0	3	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Probability and stochastic processes

Objectives:

1. Learn the language and core concepts of probability theory.
2. Understand basic principles of statistical inference

Outcomes: On successful completion, students will be able to

1. Understand probabilities distributions and densities.
2. Formulating the hypothesis.
3. Hypothesis testing using, Parametric. inferential statistical tests.
4. Hypothesis testing using, Non- Parametric. inferential statistical tests.

Detailed Syllabus:

Unit	Description	Duration
1	**Introduction** Various types of data What is and why statistics, Application of statistics to various domain, Visualization of the data (Plotting various graphs)	**04**
2	**Descriptive Statistics** Mean Median, Mode, other averages, Measure of Desperation – Range , Mean and standard deviation , Correlation Analysis: Pearson correlation and spearman's correlation coefficient	**08**
3	**Sampling mean and variance** Sampling distributions based on normal, Estimation, Properties of	**08**

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	point estimators, Confidence interval, Maximum likelihood and Bayes estimators, Prediction intervals.	
4	**Probability distributions**- Binomial, Poisson, Probability densities- Normal Distribution	**08**
5	**Inferential statistics** Hypothesis Testing: Hypothesis Test Procedure ,Type I and Type II Errors ,One-Tailed and Two-Tailed Tests(Z-Test, T –test,), Chi-square tests, Goodness of fit test	**10**
6	**Non- Parametric Tests** Wilcoxon rank sum and sign rank tests, Kruskal-Wallis test, Friedman F test, Analysis of Variance: ANOVA	**07**
	Total	**45**

Text Books:

1. Miller J.R., Freund J.E. and Johnson R: Probability and Statistics for Engineers, 9th Edition, Pearson Education, 2018.
2. Elliot A. Tanis, Robert V. Hogg, Dale L. Zimmerman, Probability and Statistical Inference, 10th Edition, Pearson Education, 2019.

Reference Books:

1. Oliver C.Ibe, Fundamental of applied probability and statistics, 2nd edition, Academic press, 2014.

Details of Internal Continuous Assessment (ICA)
Test Marks : 20
Term Work Marks : 30

Details of Term Work:
Term work should consist of the following

1. Tutorials/Assignments/Viva-voce/ Quiz/Seminar/Presentation

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Program: MBA. Tech. (EXTC)				**Semester: V**	
Course: Power Electronics (Departmental Elective - 1)				**Code:** MBET05011	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Electronic Devices, Analog Circuits

Objectives:

1. To analyze different converters and control with their applications
2. To study advanced converters and switching techniques implemented in recent technology
3. To understand, simulate and design single-phase and three-phase thyristor converters.

Outcomes:

After completion of the course, students would be able to:

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1	**Characteristics of Semiconductor Power Devices:** Thyristor, power MOSFET and IGBT structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs	08

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	and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.	
2	**Controlled Rectifiers:** Principle of Phase-Controlled converter operation, Single Phase Semi Converter and Single Phase Full Converter with R, RL, RLE load. Three Phase Half Wave Converters, Three Phase Semi Converter and Three Phase Full converter with R, RL, RLE load. Design of Converter Circuits, Effect of Load and source inductances.	09
3	**Choppers:** Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper	08
4	**Single-phase inverters:** Principle of operation of Series and Parallel, full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter	10
5	**Switching Power Supplies:** Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.	05
6	**Applications**: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, and sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.	05
	Total	45

Text Books:

1. Muhammad H. Rashid, "Power electronics", edition IV, Prentice Hall of India.
2. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.

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3. P.C. Sen., "Modern Power Electronics", edition II, Chand& Co.

Reference Books:

1. V.R.Moorthi, "Power Electronics", Oxford University Press.
2. Cyril W., Lander," Power Electronics", edition III, McGraw Hill.
3. G K Dubey, S R Doradla,: Thyristorised Power Controllers", New Age International Publishers. SCR manual from GE, USA.

Details of Internal Continuous Assessment (ICA)
Test Marks: 20
Term Work Marks: 30

Details of Term Work:
Term work should consists of the following

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.
2. Experiments covering the following topics,

- V-I characteristics of Silicon Controlled Rectifier (SCR)
- V-I characteristics of DIAC.
- Working of UJT relaxation oscillator as a gate firing circuit.
- Operation of a single phase controlled bridge converter for different values of firing angle.
- Determine the chopping frequency and output voltage of a step up chopper for different values of duty cycle.
- Determine the chopping frequency and output voltage of a step down chopper for different values of duty cycle.
- Verify the working of parallel inverter.
- Verify the working of series inverter.

3. Lab Experiments/Tutorials/Assignments/Viva-voce/ Quiz/Lab Exam/ Seminar/Presentation/Mini Project

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Program: MBA. Tech. (EXTC)				**Semester: V**	
Course: Computational Methods (Departmental Elective – 1)				**Code:** MBET05012	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Mathematics – I, II, and III. Basic Knowledge of Programming

Objectives:

1. To instill in prospective engineer's knowledge of techniques in calculus, multivariate analysis and linear algebra.
2. To equip the students with intermediate to advanced level concepts and aligned tools to help them tackle advanced mathematics and related applications.

Outcomes:

After completion of the course, students would be able to:

1. Understand the concept of floating point and errors.
2. Identify and solve problem using numerical methods
3. Implement algorithm based solution for scientific computation.

Detailed Syllabus: (per session plan)

Unit	Description	Duration
1	**Computer Arithmetic:** Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation.	**05**
2	**System of liner equations:** Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems.	**07**

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3	**Eigenvalues and singular values:** Eigen-values and Eigenvectors, Methods for Computing All Eigen-values, Jacobi Method, Methods for Computing Selected Eigen-values, Singular Values Decomposition, Application of SVD.	**06**
4	**Linear least squares:** Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting.	**07**
5	**Nonlinear equations:** Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares	**05**
6	**Interpolation:** Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation	**05**
7	**Numerical Integration and Differentiation:** Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation.	**05**
8	Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga – Kutta Method, Extrapolation Methods, Boundary Value Problems for ODES, Finite Difference Methods, Finite Element Method, Eigenvalue Problems.	**05**
	Total	**45**

Text Books:

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, 2nd Edition,2002.
2. Xin-she Yang (Ed)., "Introduction to Computational Mathematics", World Scientific Publishing Co., 2nd Edition, 2008.

Reference Books:

1. Press William T.,Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press,, 3rd Edition,2007.
2. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press,

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1st Edition, 2006.
3. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing with Matlab and Octave", Springer, 3rd Edition, 2010.

Details of Internal Continuous Assessment (ICA)
Test Marks: 20
Term Work Marks: 30

Details of Term Work:
Term work should consists of the following

1. Minimum ten experiments covering the whole syllabus, duly graded.

2. List of Experiments:

- Gauss Elimination Method
- Gauss Jordan Method
- Inverse of a Matrix by LU Decomposition
- Roots of Equation (Bisection, Secant, Regula Falasi, etc.)
- Least Square Method for generating the function
- Numerical Differentiation
- Numerical Integration
- Newton's Method of Interpolation
- Solving ODE (Euler's, Taylor's, and Runga-Kutta)
- Determining Eigen values and Eigen vectors.

3. Lab Experiments/Tutorials/Assignments/Viva-voce/ Quiz/Lab Exam/ Seminar/Presentation/Mini Project

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Program: MBA. Tech. (EXTC)				**Semester: V**	
Course: Industrial Automation (Departmental Elective – 1)				**Code:** MBET05013	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Knowledge of basic electronics and control theory

Objectives:

1. To provide knowledge to learn essential concepts behind control system elements and operations.
2. To expose students to the topics of process control, measurement, and instrumentation to allow applications-oriented design.

Outcomes:

After completion of the course, students would be able to:

1. Learn and apply essential concepts behind control system elements and operations in hydraulics and pneumatics automation.
2. Identify systems approach of the process control in industry and state-of-the-art coverage of computer integrated manufacturing using PLCs and flexible manufacturing systems as applicable in industrial applications.
3. Develop skills in handling computer-based controllers.
4. Explain fundamentals of sensorics technology and modular mechatronics along with robot technology.

Detailed Syllabus:

Unit	Description	Duration
1	**Introduction to Automation** Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations.	**04**

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2	**Introduction to Fluid Power Generating/Utilizing Elements** Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics - Linear actuator -. Reservoir capacity, heat dissipation, accumulators - standard circuit symbols, circuit (flow) analysis.	**04**
3	**Control and Regulation Elements** Direction flow and pressure control valves-Methods of actuation, types, sizing of ports-pressure and temperature compensation, overlapped and under lapped spool valves-operating characteristics- Electro Hydraulic System, Electro Hydraulic servo valves-Different types characteristics and performance.	**06**
4	**Hydraulics** Introduction to Hydraulics, Physical Fundamentals and principles, Hydraulic components (Pump, Valves, etc.), Basic hydraulics circuits and Electro Hydraulics, Practical examples based on simple automation tasks, types of proportional control devices- Pressure relief, Flow control, Direction control, Hydraulic symbols, Spool configurations, Selection & sizing with reference to manufacturer's data, Electrical operation, Basic electrical circuits and operation, Solenoid design, Comparison between conventional and proportional valves.	**06**
5	**Pneumatics** Introduction to Pneumatics, Physical Fundamentals and principles of Pneumatics, Pneumatic Components (Compressor, Valves, Compressed Air), Basic hydraulics circuits and Electro Pneumatics, Practical examples based on simple automation tasks	**06**
6	**Control schemes & controllers** On/OFF control, P, PI, PID control, related terminologies, parameter adjustments and implications Electronic P, PI & PID controller. Data acquisition, set point control, direct digital control Review of Z-transform theory and its application in digital control Digital PID algorithms	**06**
7	**PLC** Introduction to Automation Technology and Programming Languages (Ladder Diagram), Interface I/O modules with PLC, Working principle of relays and contactors, Area of application, Programming with Relay and PLC	**07**

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8	**Sensorics, Robotics and Mechatronics** Introduction to Sensorics Technology, Basics and Fundamentals, Functions of Inductive, Capacitive, Magnetic, Ultrasonic and Optical types of sensors, Introduction to Robot Technology Basics of Mechatronics and Modular Mechatronics.	**06**
	Total	**45**

Text Books:

1. Johnson Curtis, Process Control Instrumentation Technology, Prentice hall of India, 8th edition, 2007.
2. Mikell P. Groover, Automation, Production Systems and Computer-Integrated Manufacturing, Pearson Education, 4th edition, 2016.

Reference Books:

1. Ilango Sivaraman, Introduction to Hydraulics and Pneumatics, PHI Learning Pvt Ltd.**, 3rd** edition, **2017.**
2. Study Material from Bosch-Rexroth Automation Company.

Details of Internal Continuous Assessment (ICA)
Test Marks: 20
Term Work Marks: 30

Details of Term Work:
Term work should consists of the following

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.
2. Experiments covering the following topics:
    - Pump characteristics
    - Basic (manual) hydraulic circuits
    - Electrohydraulic circuits
    - Basic pneumatic circuits
    - Electropneumatic circuits
    - Sequencing circuits with pneumatics
    - Sensors (inductive, capacitive, magnetic, ultrasonic, photoelectric)
    - PLC programming (ladder diagram)
    - Electronic controllers (P, PI, PD, PID)

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3. Lab Experiments/Tutorials/Assignments/Viva-voce/ Quiz/Lab Exam/ Seminar/Presentation/Mini Project

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Program: MBA. Tech. (EXTC)				**Semester : V**	
Course : Image and Video Processing (Departmental Elective – 1)				**Code:** MBET05014	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Knowledge of Digital Time Signal Processing

Objectives:

1. To understand Image fundamentals and resolutions
2. To comprehend Image processing techniques in spatial and frequency domain
3. To design techniques for filtering images and feature extraction.
4. To develop image and video processing applications in practice

Outcomes:

After the successful completion of this course, the student will be able to

1. Apply spatial domain techniques for grey and color image enhancement.
2. Implement various transforms to convert and process image in frequency domain.
3. Understand various morphological operations and segmentation techniques for images.
4. Use motion estimation techniques for analysis of video signals

Detailed Syllabus:

Unit	Description	Duration
1.	**Image Fundamentals:** Basics of sampling and quantization, Representing Digital Image, Spatial and Gray level resolution, Basic relationships between pixels, RGB ,HSI, CMY and CMYK colour models	**04**
2.	**Image Enhancement** **Spatial Domain:** **Point Processing-** Digital negative, contrast stretching,	**10**

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	thresholding, gray level slicing, bit plane slicing, log transformation, power law transformation. **Neighbourhood Processing:** Smoothing spatial filters, Sharpening spatial filters. **Color image enhancement:** intensity transformation and spatial filters **Frequency Domain:** 2-D DFT and its properties, Ideal, Butterworth and Gaussian Smoothing and Sharpening filters, Homomorphic filtering **Histogram processing:** Histogram equalization, histogram specification.	
3.	**Image Transforms:** Walsh transform, Hadamard transform, Discrete cosine transform, Slant transform, Discrete Wavelet Transform	**08**
4.	**Morphological Image Processing:** Dilation, erosion, opening, closing, Hit –or-Miss transformation **Basic Morphological Algorithms**: Boundary extraction on binary images, Region filling , Skeletonization	**06**
5.	**Image Segmentation:** **Detection of discontinuities:** Point, Line and Edge detection **Edge linking and boundary detection:** Local processing, global processing via Hough transform, Global processing via Graph Theoretic techniques. **Thresholding** **Region based segmentation**: Region growing, region splitting and merging	**08**
6.	**Fundamentals of Digital Video** **Video Formation , Perception and Representation:** Digital video sampling, temporal correlation, video frame classifications, I, P and B frames, Digital video quality measure.	**04**
7.	**Digital Video Processing Techniques** Fundamentals of motion estimation and compensation General methodologies in motion estimation: Motion representation, Motion Estimation Algorithms: Sequential Search Block Matching, Hierarchical Block Matching Algorithm	**05**
	Total	**45**
Text Books:		

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1. Rafael.C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education, 4th Edition, 2019.
2. Oge Marques, Practical Image and Video Processing using Matlab, IEEE Press, John Wiley & Sons Publication, 2011.

Reference Books:

1. **Li**, Ze-Nian, **Drew**, Mark S., **Liu**, Jiangchuan, "Fundamentals of Multimedia", Springer, 2nd Edition, 2014.
2. Scotte Umbaugh, Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools, 2nd edition, CRC Press, 2011.

Details of Internal Continuous Assessment (ICA)

Test Marks : 20

Term Work Marks : 30

Term Work:

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.
2. Experiments covering the following topics
    - Colour image to grey scale
    - Image enhancement using point processing techniques
    - Grey scale and sampling resolution
    - Image enhancement using neighbourhood processing
    - Histogram processing
    - Frequency domain filtering
    - Image Transform
    - Morphological algorithms
    - Edge detection techniques
    - Basic video processing techniques
3. Lab Experiments/Tutorials/Assignments/Viva-voce/ Quiz/Lab Exam/ Seminar/Presentation

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Program:	**MBA. Tech. (EXTC)**			**Semester : V**	
Course :	Digital Television Systems (Departmental Elective – 1)			**Code :** MBET05015	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
3	2	0	4	Marks Scaled to 50	Marks Scaled to 50

Pre-requisite: Knowledge of Analog Circuits, Analog and Digital communication.

Objectives:

1. To provide knowledge and principle of Colour TV and Advanced TV systems.
2. To teach fundamentals of colour signal transmission and their standards.
3. To introduce principles of display technologies like LCD TV and LED TV.
4. To give an insight of the concepts of digital signal transmission and principle of Digital TV, HDTV, EDTV, IPTV and 3D TV.

Outcomes:

After completion of the course, students would be able to:

1. Understand the working principles of various colour TV systems.
2. Apply knowledge of basic colour TV systems for advanced TV technologies.
3. Analyze the principles of various display technologies.
4. Analyse the fundamentals of digital signal transmission.

Detailed Syllabus:

Unit	**Description**	**Duration**
1.	**Fundamentals of Colour Television:** Compatibility and reverse compatibility, colour perception, Three colour theory, luminance, hue and saturation, colour TV camera, generation of luminance and colour difference signals, unsuitability of (G-Y) signal for transmission. **Colour signal transmission**: Frequency interleaving, bandwidth,	**06**

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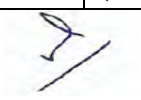
	Quadrature AM, colour burst signal, weighting factors, formation of chrominance signal, colour signal Phasor diagram.	
2.	**Colour TV Systems:** **NTSC colour TV system**: Phasor diagram of I and Q signals, colour subcarrier frequency, coder and decoder, limitations. **PAL colour TV system**: features, PAL burst, cancellation of phase errors, PAL-D demodulation, choice of colour subcarrier frequency, PAL coder and decoder, merits and demerits, **SECAM III colour TV system**: Coder and decoder, merits and demerits.	**08**
3.	**LCD :** Liquid crystal display **(**LCD) technology, Liquid crystals, operation of Liquid crystal display, Twisted Nematic (TN) transmissive LCD, passive and active- matrix LCD's, TFT-LCD panel drive, Backlight assembly. **LED TV:** LED technology, materials used for LED's, working of LED TV, Parameters of a LED module, advantages of LED screens, comparison of LCD, edge lit LED and back lit LED TV, Organic LED TV (OLED).	**06**
4.	**Digital Television Transmission Standards:** ATSC terrestrial transmission standard, vestigial sideband modulation, DVB-T transmission standard, ISDB-T transmission standard, channel allocations, antenna height and power.	**07**
5.	**Digital TV:** Principles of digital video broadcasting: digitization, compression and channel encoding, Standard definition (SDTV) sampling rate, video sampling, MPEG encoding: components of DTV, Video-MPEG-2 coding, MPEG video compression, Digital TV receiver, Merits of Digital TV receivers, Direct to home (DTH) Television system.	**08**



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6.	**High definition TV (HDTV):** Advantages of HDTV, HDTV parameters, comparison of SDTV and HDTV aspect ratio, HDTV common interface format, Introduction to Ultra HDTV, Extended definition TV.	**04**
7.	**IPTV:** Internet protocol TV technology, On-line convergence, Asymmetrical digital subscriber line (ADSL) bandwidth allocation, Bit rates, Closed IPTV network, Video on demand, comparison of IPTV and cable technology. **3 D TV:** Introduction to 3 D TV technology, three dimensional video displays.	**06**
	Total	**45**

Text Books:

1. Gulati R.R, Monochrome and Colour Television, New Age International, 3rd edition, 2014.
2. K.F. Ibrahim, Newnes guide to Television and Video technology, 4th edition, 2007.

Reference Books:

1. Gerald w. Collins, Fundamentals of Digital Television Transmission, John Wiley & Sons, 2001.
2. Gulati R. R., Modern Television Practice: Transmission, Reception and Applications, New Age International, 5th edition, 2015.
3. Herve Benoit , Digital Television, 2nd Edition, Focal Press, 2002.

Details of Internal Continuous Assessment (ICA)
Test Marks: 20
Term Work Marks: 30

Details of Term Work:
Term work should consist of the following

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.

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2. Experiments covering the following topics:
    - Working of Colour TV receiver.
    - Measurement of Composite video signal for various video patterns and corresponding sweep waveform in the Colour TV receiver.
    - Construction of Colour picture tube, and measuring various voltages.
    - Learn fault creation and rectification at various stages of T.V
    - Installation of satellite dish antenna and measurement of LNB frequency, RF power with DTH system for reception of TV channels.
    - Comparison of Analog colour TV (CRT) and LCD TV.
    - Utilization of LCD screen and set top box to receive the satellite TV station to get satellite TV reception on PC monitor (Input given from Camera or Indoor antenna).
    - Measurement of different voltages using Switch mode power supply (SMPS).
    - Comparison of various Advanced Television Technologies.

3. Lab Experiments/Tutorials/Assignments/Viva-voce/ Quiz/Lab Exam/ Seminar/Presentation

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Program: MBA. Tech. (EXTC)				**Semester : V**	
Course : Minor Project				**Code :** MBET05016	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks-50)**	**Term End Examinations (TEE) (Marks -100 in Question Paper)**
0	2	0	1	Marks Scaled to 50	--

Pre-requisite: Basic knowledge subjects studied till semester V

Objectives:

1. To be able to implement the project.
2. Circuit building/Simulation of the project.
3. Testing of the results, validation.

Outcomes:

After the successful completion of this course, the student will be able to

1. Select an appropriate design based topic.
2. Know about the different methods for implementation of design.
3. Formulate the feasible design model.
4. Summarize the topic into a technical report and demonstrate the model.

Activities to be done in Minor Project:

1. The Project group to be formed consisting of not more than 3 students.
2. The Project area and topic is to be selected in consultation with Project Mentors, alternatively students can propose the topics.
3. Topics can be selected using subjects studied up to semester V and based on latest technology
4. The minor project will involve development implementation and testing of the module/circuit.
5. A mid-term presentation based on Literature survey and Design overview.
6. Report primarily containing the entire overview of the Project from Literature Survey, Feasibility Study, Design, Analysis, Implementation, and Testing is to be submitted at the end of the semester
7. Presentation (about 30 minutes) of the work done during the semester to be evaluated by Internal Examiner and External Examiner.

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Evaluation Scheme:
Mid-Term Presentation: 10 marks
End-Term Presentation and demonstration: 40 marks

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Program: MBA. Tech. (EXTC)					**Semester: V**
Course: Environmental Studies					**Code:** MBET05017
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks - 50)**	**Term End Examinations (TEE) (Marks- -- in Question Paper)**
2	0	0	0	Marks Scaled to 50	--

Pre-requisite: Chemistry, Physics

Objectives:

1. Introduce – Environment, Environmental Pollution,
2. Acquaint with Social Issues and methods to manage them
3. Improving Planning of activities

Outcomes:

After completion of the course, students would be able to:

1. Discuss Types of Environmental Pollution, Natural resources and its misuse, Importance of Environmental management for Construction Projects
2. Prepare plan for water management, promotion of recycle and reuse, generation of less waste, avoiding electricity waste
3. Prepare Slogan, Poster and plan activities for environmental protection and social issues

Detailed Syllabus:

Unit	**Description**	**Duration**
1	Introduction to Environment and its components: Natural Resources and it Misuse leading to Environmental degradation. Role of Ecology in Environmental Degradation and Protection. Major industrial and other environmental disasters	**08**

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	Environmental pollution- Types, Causes, Effects, Reduction methodology.	
2	Introduction to waste generation, Methods to Reduce, Reuse and Recycle of Waste Importance of 3R's, Promotion of 3R's - Methods Solid wastes, Industrial Waste, Bio-Medical Waste and Hazardous waste management – Types, Storage, Transportation, Treatment Disposal. C&D and E-waste – Concept, methods for reduction, management Campaigning for waste reduction and management.	**08**
3	Concept of EIA and SIA, significance, methodology, report drafting. Environmental Management System, ISO 14000 EMS certification	**05**
4	Environmental Protection, Social Issues, Disaster Management Social Issues and Environment International Conventions, Summits and Protocols Generation of less waste and avoiding electricity waste. Environmental management for construction Projects	**05**
5	Role of the Government in managing the environmental activities in all sectors. Organisational set up at the Central and state level to manage the environment. Role of judiciary in managing the environment. Role of Citizens, Role of NGOs/ Environmental Activists. Major Laws Air (P&C.P.) Act, Water (P & C.P) Act. Environment Protection Act EPA 1986. Wild life Protection Act etc., PIL	**04**
	Total	**30**

Text Books:

1. Benny Joseph (2017), "Environmental Studies", *The McGraw-Hill Companies*
2. Gerard Kiely (2007), "Environmental Engineering", *Tata McGraw-Hill Education*

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Reference Books:

1. P. Aarne Vesilind, Susan M. Morgan (2004), "Introduction to Environmental Engineering", *Thomas/Brook/Cole*.
2. Mackenzie Davis, David Cornwell (2017), "Introduction to Environmental Engineering", *McGraw-Hill Companies.*

Any other information: NIL

Details of Internal Continuous Assessment (ICA):

Test Marks: 20

Term Work Marks: 30

Details of Term work:

Term work should consist of the following:

1. Minimum five assignments on the above syllabus
2. Report on Social Issues
3. Report on Environmental Management Case Study

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SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering
Electronics & Telecommunication (2020 – 2021)

<table>
<tr><td colspan="4">Program: MBA Tech. (EXTC)</td><td colspan="2">Semester : VII</td></tr>
<tr><td colspan="4">Course : Digital Voice and Broadband Communication</td><td colspan="2">Code : MBET07001</td></tr>
<tr><td colspan="4">Teaching Scheme</td><td colspan="2">Evaluation Scheme</td></tr>
<tr><td>Lecture Hours per week</td><td>Practical Hours per week</td><td>Tutorial Hours per week</td><td>Credit</td><td>Theory (3 Hrs, 70 Marks)</td><td>Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)</td></tr>
<tr><td>3</td><td>0</td><td>2</td><td>4</td><td>Scaled to 70 Marks</td><td>Scaled to 30 Marks</td></tr>
<tr><td colspan="6">Pre-requisite Knowledge of Digital Communication and Computer networks</td></tr>
<tr><td colspan="6">Objectives:
1. To provide knowledge of basic Telephony and characterise the traffic in telephone network.
2. To study various types of digital switching and signalling techniques.
3. To have an insight into the ISDN and B-ISDN.
4. To understand the need and process of transition from traditional communication networks to broadband communication networks.
5. To explore Voice over IP.
6. To explain the functionality of different building blocks of broadband technology.</td></tr>
<tr><td colspan="6">Outcomes:
After the successful completion of this course, the student will be able to
1. Explain the basic concepts of telephony.
2. Analyse and characterize the traffic in telephone network.
3. Explain the B-ISDN and signalling in telephony.
4. Discuss the Broadband Access Technologies.
5. Describe and compare the different broadband network access techniques of cable modem service, optical fiber based access, and broadband wireless access techniques of Wi-Fi and Wi-MAX networks.
6. Describes the voice coding techniques and different protocols used for VoIP.</td></tr>
</table>

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Detailed Syllabus:		
Unit	**Description**	**Duration**
1.	**Telephony Background:** Analogue networks, subscriber loop design, calculating resistance Limit, calculating loss limit, Transmission Impairments in Subscriber loop.	**03**
2.	**Telephone traffic theory:** Traffic characterization, arrival and holding time, Erlang formula and Tables, loss systems, lost calls, network blocking probabilities, delay systems, measurement of traffic congestion, lost calls and grade of service.	**04**
3.	**Digital switching and Synchronisation:** Voice digitization Multi channel PCM, Frame/multiframe/signalling formats, Higher order multiplexing, Line codes, Space division switching, time division switching, time space time (TST) switch, space time space (STS) switch, comparison of TST and STS switches, Blocking and Non-blocking switches. **Network Synchronization:** Need for synchronization, Methods for synchronization Timing recovery (PLL), Clock Instability, Elastic stores, Timing inaccuracies, Slips, Pulse Stuffing. **Signalling:** Types of Signalling, Channel Associated signalling, Common Channel Signalling, SS7.	**08**
4.	**Integrated service digital network (ISDN):** ISDN overview, ISDN interfaces and functions, transmission structure, **Broadband ISDN (B - ISDN):** (B - ISDNS) standards, architecture protocol reference model, B-ISDN lower layers.	**04**
5.	**The Basics of Broadband Technology:** Digital Subscriber Line (ADSL, HDSL, RADSL, VDSL, G.lite), Access network architecture (DSLAM), Modulation technologies (DMT), CAP	**05**
6.	**Voice over IP:** Voice coding, properties of speech, waveform coding, vocoding, hybrid coding, VoIP architecture, VoIP Protocols: Resource reservation protocol (RSVP), Multi Protocol Label Switching (MPLS), real time protocol (RTP), session	**06**

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	initiation protocol (SIP). H.323 standard media gateway control protocol.	
7.	**Broadband ATM Switching & Transmission:** Broadband IP Switching over ATM, Broadband Transmission Network for LAN & WAN, SONET/ SDH	**05**
6.	**Broadband Access Technologies:** Cable Modem Service: Head end and regional network architecture, Cable Modem Termination System, CMTS, Hybrid Fiber Coax networks HFC, Cable Labs initiatives (DOCSIS. PacketCable, CableHome) Optical Fiber-based Networks: Passive Optical Network (PON) architecture (Optical line termination, optical network terminals), Standards (BPON, GPON, EPON) Fixed and Mobile WiMAX : Architecture, Standards (IEEE 802.11, 802.15, 802.16), Services Comparison of broadband access techniques	**10**
	Total	**45**

Text Books:

1. Digital Telephony - John C. Bellamy, Wiley India, 3rd edition, 2011.
2. ISDN and Broadband ISDN with Frame Relay and ATM – William Stalling., Pearson education Asia publication, 4th Edition, 2002.
3. Leonhard Korowajczuk, LTE, WiMAX and WLAN Network Design, Optimization and Performance Analysis, John Willey Publication, 1st edition, 2011.
4. Communication Networks – Alberto Leon-Garcia, Tata McGraw Hill Publication, Second edition, 2004.

Reference Books:

1. Fundamentals of Telecommunication – Roger L. Freeman, John Wiley and Sons, Inc., Publication, first edition, 1999
2. Andy Valder, Understanding telecommunication network, IET, 1st Edition 2006.

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3. Telecommunications and Data Communications Handbook – Ray Horak, A John Wiley and Sons, Inc., Publication, first edition, 2007

Term Work:

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.
2. Presentation/Application based experiment and Quiz/Practical exam/Viva/Any other mode of evaluation.

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Program: MBA Tech. (EXTC)				**Semester : VII**	
Course : Wireless Communication Technology				**Code :** MBET07002	
Teaching Scheme				**Evaluation Scheme**	
Lecture Hours per week	**Practical Hours per week**	**Tutorial Hours per week**	**Credit**	**Theory (3 Hrs, 70 Marks)**	**Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)**
3	2	0	4	Scaled to 70 Marks	Scaled to 30 Marks

Pre-requisite: Principles of Communications Engineering and digital communication

Objectives:

1. To provide the knowledge of mobile communication systems in various aspects and trends.
2. To understand the mobile radio propagation mechanism.
3. To understand 2G (GSM, GPRS,EDGE), 3G cellular mobile systems.
4. To understand LTE and 4G: emerging technologies for wireless communication.

Outcomes:

After the successful completion of this course, the student will be able to

1. Recognize the significance of cellular concept and the capacity of wireless communication.
2. Explain the mobile radio propagation mechanism.
3. Describe the working and application of GSM, CDMA and 3G (UMTS, IMT 2000) mobile systems.
4. Describe the techniques and technological advancement in LTE and 4G networks.

Detailed Syllabus:

Unit	**Description**	**Duration**
1.	**The cellular concept:** Introduction to cellular system, Frequency reuse, handoff, interference, methods of improving the capacity of cellular systems, Packet radio	**05**

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2.	**Mobile radio propagation:** Large scale path loss, reflection, ground reflection model (2 ray model), diffraction, practical link budget design using path loss models, small scale fading and multi-path, small-scale multipath propagation, parameter of multi-path channels, types of small scale fading, Rayleigh and Ricean distribution.	**08**
3.	**2G Technologies:** **Global System for Mobile Communication (GSM)** GSM-services, features, radio specifications, system architecture, channel types, frame structure, security aspects, network operations **GSM evolution:** GPRS and EDGE; Architecture and services offered **Code Division Multiple Access (CDMA) digital cellular standard :** Soft hand off and power control, Radio Specifications, forward and reverse CDMA channel.	**12**
4.	**3G Technologies**: **Universal Mobile Terrestrial system (UMTS):** System architecture, air interface specification, forward and reverse channels in Wideband CDMA (WCDMA) and CDMA 2000.	**06**
5.	**3GPP LTE and 4G** Introduction and system overview, Frequency bands and spectrum, network structure, and protocol structure, Frame slots and symbols, Logical and Physical Channels: Mapping of data on to logical sub-channels physical layer procedures, establishing a connection, retransmission and reliability, power control. 4G : Introduction, features and architecture Multi antenna Technologies: MIMO	**10**

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6.	**Emerging Technologies:** **5G** Characteristics envisioned for 5G, specifications and architecture **SDN(Software Defined Network)** Objective and architecture	**04**
	Total	**45**

Text Books:

1. Theodore S. Rappaport, Wireless Communications, Prentice Hall of India, PTR publication, 2nd edition, 2011.
2. Andreas F. Molisch , Wireless Communications, Wiley, 2nd edition, 2010

Reference Books:

1. Jochen H. Schiller, Mobile Communication, Pearson, 2nd edition, 2010.
2. Gary J. Mullet, Introduction to wireless telecommunications systems and networks, Cengage learning, 1st edition, 2011.

Term Work:

1. At least ten laboratory experiments based on the entire syllabus duly recorded and graded.
2. Presentation/Application based experiment and Quiz/Practical exam/Viva/Any other mode of evaluation.

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Program: MBA Tech. (EXTC)				**Semester : VII**
Course : Project Phase I				**Code :** MBET07003
Teaching Scheme				**Evaluation Scheme**
Lecture Hours per week	**Practical Hours per week**	**Tutorial Hours per week**	**Credit**	**Internal Continuous Assessment (ICA) As per Institute Norms (100 Marks)**
0	8	0	4	Scaled to 100 Marks

Pre-requisite: Core EXTC subjects till 3rd year

Objectives:

1. To do literature survey in the topic selected for major project.
2. To explore the feasibility of the project.
3. To design and formulate the work to be carried out in next phase.

Outcomes:

After the successful completion of this course, the student will be able to

1. Select an appropriate problem statement.
2. Analyze different designing parameters.
3. Formulate the feasible design model.

Activities to be done in phase I:

1. The Project group to be formed consisting of not more than 3 students.
2. The Project area and topic is to be selected in consultation with Project Mentors, alternatively students can propose the topics.
3. The Names of the students and the topic of the Project to be submitted in the first week of the Trimester along with Name of the Mentor.
4. The first phase of the project will involve Literature Survey, feasibility study, Design and Part Implementation.
5. Student is required to submit a 1-2 pages weekly report on the work done to the mentor. Attendance will be given on the report. There would continuous evaluation based on the weekly report submitted for 50 marks.
6. Report primarily containing Literature Survey, feasibility study, Design and Part Implementation is to be submitted at the end of the Semester. (Spiral Bound Report)
7. Presentation (about 30 minutes) of the work done during the Semester to be evaluated by External Examiner and Project Mentor.

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Details of Internal Continuous Assessment (ICA)
Test Marks : NA
Term Work Marks : 100

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