B.E E&C FOURTH SEMESTER SYLLABUS

<table>
<tr><td colspan="4" align="center">ENGINEERING MATHEMATICS-IV
B.E., IV Semester, Common to all Branches
[As per Choice Based Credit System (CBCS) Scheme]</td></tr>
<tr><td>Course Code</td><td>15MAT41</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>04</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50 (10 Hours per Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits – 04</td></tr>
</table>

Course Objectives: This course will enable students to:

- Conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering.

Module-1

Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae). **L1, L3**

Module-2

Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne's method.

Special Functions: Series solution-Frobenious method. Series solution of Bessel's differential equation leading to $J_n(x)$-Bessel's function of first kind. Basic properties and orthogonality. Series solution of Legendre's differential equation leading to $P_n(x)$-Legendre polynomials. Rodrigue's formula, problems. **L3**

Module-3

Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems. **L1, L3**

Transformations: Conformal transformations, discussion of transformations: $w=z^2$, $w=e^z$, $w=z+\sqrt[4]{z}$ $\{ \neq 0$ and bilinear transformations-problems. **L1**

Module-4

Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient. **L3**

Module-5
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **L3**   **Stochastic process:** Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems. **L1**
Course Outcomes: On completion of this course, students are able to: • Solve first and second order ordinary differential equations arising in flow problems using single step and multistep numerical methods.   • Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory.   • Describe conformal and bilinear transformation arising in aerofoil theory, fluid flow visualization and image processing.   • Solve problems of quantum mechanics, hydrodynamics and heat conduction by employing Bessel's function relating to cylindrical polar coordinate systems and Legendre's polynomials relating to spherical polar coordinate systems.   • Solve problems on probability distributions relating to digital signal processing, information theory and optimization concepts of stability of design and structural engineering.   • Draw the validity of the hypothesis proposed for the given sampling distribution in accepting or rejecting the hypothesis.   • Determine joint probability distributions and stochastic matrix connected with the multivariable correlation problems for feasible random events.   • Define transition probability matrix of a Markov chain and solve problems related to discrete parameter random process.
Text Books: 1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.   2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons,10th Ed., 2015.
Reference Books: 1. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers,7th Ed., 2010.   2. B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.   3. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.
Web Link and Video Lectures: 1. http://nptel.ac.in/courses.php?disciplineID=111   **2.** http://www.khanacademy.org/   3. http://www.class-central.com/subject/math

<table>
<tr><td colspan="4"><u>ADDITIONAL MATHEMATICS - II</u>
B.E., IV Semester, Common to all Branches
(A Bridge course for Lateral Entry students of IV Sem. B. E.)
[As per Choice Based Credit System (CBCS) Scheme]</td></tr>
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Course Code	15MATDIP41	CIE Marks	--
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03

Credits – 00

Course Objectives: This course will enable students to:

- Understand essential concepts of linear algebra.
- Solve second and higher order differential equations.
- Understand Laplace and inverse Laplace transforms and elementary probability theory.

Module-1

Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples. **L1,L3**

Module-2

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. Solutions of initial value problems. Method of undetermined coefficients and variation of parameters. **L1,L3**

Module-3

Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals**,** transforms of periodic function and unit step function- Problems only. **L1,L2**

Module-4

Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods. Application to solutions of Linear differential equations and simultaneous differential equations.   **L1,L2**

Module-5

Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. Bayes's theorem-examples.   **L1,L2**

Course Outcomes: On completion of this course, students are able to:

- Solve systems of linear equations in the different areas of linear algebra.

- Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations.

- Describe Laplace transforms of standard and periodic functions.

- Determine the general/complete solutions to linear ODE using inverse Laplace transforms.

- Recall basic concepts of elementary probability theory and, solve problems related

to the decision theory, synthesis and optimization of digital circuits.

Text Book:

B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.

SIGNALS AND SYSTEMS			
SEMESTER – IV (EC/TC)			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	**17EC42**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**
CREDITS – 04			

Course objectives: This course will enable students to:
- Understand the mathematical description of continuous and discrete time signals and systems.
- Analyze the signals in time domain using convolution difference/differential equations
- Classify signals into different categories based on their properties.
- Analyze Linear Time Invariant (LTI) systems in time and transform domains.
- Build basics for understanding of courses such as signal processing, control system and communication.

Module -1

Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.
Elementary signals/Functions: Exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sync functions.
Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.
Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non- causal, static and dynamic, stable and unstable, invertible. **L1, L2, L3**

Module -2

Time domain representation of LTI System: System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral and convolution sum using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Properties of convolution.
L1, L2, L3

Module -3

System interconnection, system properties in terms of impulse response, step response in terms of impulse response (4 Hours).

Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition, properties (No derivation) and basic problems (inverse Fourier series is excluded) (06 Hours). **L1, L2, L3**

Module -4

Fourier Representation of aperiodic Signals:
FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance (4 Hours).
FT representation of aperiodic discrete signals-DTFT, definition, DTFT of standard discrete signals, Properties and their significance (4 Hours).
Impulse sampling and reconstruction: Sampling theorem (only statement) and reconstruction of signals (2 Hours). **L1, L2, L3**

Module -5
Z-Transforms: Introduction, the Z-transform, properties of the Region of convergence, Properties of the Z-Transform, Inversion of the Z-Transform, Transform analysis of LTI systems. **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:
- Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and deterministic/random signals.   - Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.   - Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum.   - Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis.   - Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems.

Text Book:
Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, WileyIndia. ISBN 9971-51-239-4.

Reference Books:
1. **Michael Roberts,** "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab,** "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. **H. P Hsu, R. Ranjan,** "Signals and Systems", Scham's outlines, TMH, 2006.
4. **B. P. Lathi,** "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga,** "Signals and Systems", Pearson/Sanguine Technical Publishers, 2004.

<table>
<tr><td colspan="4" align="center">CONTROL SYSTEMS
SEMESTER – IV (EC/TC)
[As per Choice Based Credit System (CBCS) Scheme]</td></tr>
<tr><td>Course Code</td><td>17EC43</td><td>CIE Marks</td><td>40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>04</td><td>SEE Marks</td><td>60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50(10 Hours per Module)</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 04</td></tr>
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Course objectives: This course will enable students to:

- Understand the basic features, configurations and application of control systems.
- Understand various terminologies and definitions for the control systems.
- Learn how to find a mathematical model of electrical, mechanical and electro-mechanical systems.
- Know how to find time response from the transfer function.
- Find the transfer function via Masons' rule.
- Analyze the stability of a system from the transfer function.

Module -1
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs. **L1, L2, L3**

Module -2
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design). **L1, L2, L3**

Module -3
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci. **L1, L2, L3**

Module -4
Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded) Introduction to lead, lag and lead-lag compensating networks (excluding design). **L1, L2, L3**

Module -5

Introduction to Digital Control System: Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diaganolisation.
L1, L2, L3

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

- Develop the mathematical model of mechanical and electrical systems
- Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method
- Determine the time domain specifications for first and second order systems
- Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.
- Determine the stability of a system in the frequency domain using Nyquist and bode plots
- Develop a control system model in continuous and discrete time using state variable techniques

Text Book:
J.Nagarath and M.Gopal, " Control Systems Engineering", New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.

Reference Books:
1. "Modern Control Engineering," K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7.

2. "Automatic Control Systems", Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.

3. "Feedback and Control System," Joseph J Distefano III et al., Schaum's Outlines, TMH, 2nd Edition 2007.

<table>
<tr><td colspan="5" align="center">PRINCIPLES OF COMMUNICATION SYSTEMS
SEMESTER – IV (EC/TC)
[As per Choice Based Credit System (CBCS) Scheme]</td></tr>
<tr><td>Course Code</td><td>17EC44</td><td>CIE Marks</td><td colspan="2">40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>04</td><td>SEE Marks</td><td colspan="2">60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50 (10 Hours per Module)</td><td>Exam Hours</td><td colspan="2">03</td></tr>
<tr><td colspan="5" align="center">CREDITS – 04</td></tr>
</table>

Course objectives: This course will enable students to:
- Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals.
- Understand the concepts in Angle modulation for the design of communication systems.
- Design simple systems for generating and demodulating frequency modulated signals.
- Learn the concepts of random process and various types of noise.
- Evaluate the performance of the communication system in presence of noise.
- Analyze pulse modulation and sampling techniques.

Module – 1

AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector.

DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.

SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television. (Chapter 3 of Text). **L1, L2, L3**

Module – 2

ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver (refer Chapter 4 of Text). **L1, L2, L3**

Module – 3

RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions (refer Chapter 5 of Text).

NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure (refer Section 6.7 of Text). **L1, L2, L3**

| Module – 4 |

NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM (refer Chapter 6 of Text). **L1, L2, L3**

| Module – 5 |

DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing (refer Chapter 7 of Text), Application to Vocoder (refer Section 6.8 of Reference Book 1). **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:
- Determine the performance of analog modulation schemes in time and frequency domains.
- Determine the performance of systems for generation and detection of modulated analog signals.
- Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms.
- Characterize the influence of channel on analog modulated signals
- Determine the performance of analog communication systems.
- Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.

Text Book:

   Communication Systems, Simon Haykins & Moher, 5th Edition, John Willey, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.

Reference Books:

1. **Modern Digital and Analog Communication Systems,** B. P. Lathi, Oxford University Press., 4th edition.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008, ISBN 978–81–265–3653–5.
3. **Principles of Communication Systems**, H.Taub & D.L.Schilling, TMH, 2011.
4. **Communication Systems**, Harold P.E, Stern Samy and A.Mahmond, Pearson Edition, 2004.
5. **Communication Systems**: **Analog and Digital,** R.P.Singh and S.Sapre: TMH 2nd edition, 2007.

LINEAR INTEGRATED CIRCUITS SEMESTER – IV (EC/TC) [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC45	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			

Course objectives: This course will enable students to:

- Define and describe various parameters of Op-Amp, its characteristics and specifications.
- Discuss the effects of Input and Output voltage ranges upon Op-Amp circuits.
- Sketch and Analyze Op-Amp circuits to determine Input Impedances, output Impedances and other performance parameters.
- Sketch and Explain typical Frequency Response graphs for each of the Filter circuits showing Butterworth and Chebyshev responses where ever appropriate.
- Describe and Sketch the various switching circuits of Op-Amps and analyze its operations.
- Differentiate between various types of DACs and ADCs and evaluate the performance of each with neat circuit diagrams and assuming suitable inputs.

Module – 1

Operational Amplifier Fundamentals:

Basic Op-amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. **OP-Amps as DC Amplifiers** – Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers. Interpretation of OP-amp LM741 & TL081 datasheet. **(Text1) L1, L2,L3**

Module – 2

Op-Amps as AC Amplifiers: Capacitor coupled voltage follower, High input impedance – Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, High input impedance – Capacitor coupled Non inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier.

OP-Amp Applications: Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers.**(Text1) L1, L2,L3**

Module – 3

More Applications : Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors, inverting Schmitt trigger. **(Text 1)**
Log and antilog amplifiers, Multiplier and divider. **(Text2) L1, L2,L3**

Module – 4
Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Bandstop Filter. **(Text 1)**
Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators. **(Text 2)   L1, L2,L3**

Module – 5
Phase locked loop: Basic Principles, Phase detector/comparator, VCO. **DAC and ADC convertor**: DAC using R-2R, ADC using Successive approximation.
Other IC Application: 555 timer, Basic timer circuit, 555 timer used as astable and monostable multivibrator. **(Text 2) L1, L2,L3**

Course Outcomes: After studying this course, students will be able to: ● Explain Op-Amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate. ● Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower. ● Test circuits of Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers. ● Test circuits of Op-Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider. ● Design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps. ● Explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer.

Text Books:
1. "Operational Amplifiers and Linear IC's", David A. Bell, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9.

2. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4thedition, Reprint 2006, New Age International ISBN 978-81-224-3098-1.

Reference Books:

1. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.

2. B Somanathan Nair, "Linear Integrated Circuits: Analysis, Design & Applications," Wiley India, 1st Edition, 2015.

3. James Cox, "Linear Electronics Circuits and Devices", Cengage Learning, Indian Edition, 2008, ISBN-13: 978-07-668-3018-7.

4. Data Sheet: http://www.ti.com/lit/ds/symlink/tl081.pdf.

MICROPROCESSORS			
SEMESTER – IV (EC/TC)			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	**17EC46**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (08 Hours per Module)**	**Exam Hours**	**03**
CREDITS – 03			

Course objectives: This course will enable students to:
- Familiarize basic architecture of 8086 microprocessor
- Program 8086 Microprocessor using Assembly Level Language
- Use Procedures in 8086 Programs
- Understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design
- Understand the Von-Neumann, Harvard, CISC & RISC CPU architecture.

Module -1

8086 PROCESSOR: Historical background (refer Reference Book 1), 8086 CPU Architecture (1.1 – 1.3 of Text).

Addressing modes, Machine language instruction formats. (2.2, 2.1 of Text).

INSTRUCTION SET OF 8086: Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs (2.3 of Text). **L1, L2, L3**

Module -2

Logical Instructions, String manipulation instructions, Flag manipulation and Processor control instructions, Illustration of these instructions with example programs. Assembler Directives and Operators, Assembly Language Programming and example programs (2.3, 2.4, 3.4 of Text). **L1, L2, L3**

Module -3

Stack and Interrupts:
Introduction to stack, Stack structure of 8086, Programming for Stack. Interrupts and Interrupt Service routines, Interrupt cycle of 8086, NMI, INTR, Interrupt programming, Timing and Delays. (Chap. 4 of Text). **L1, L2, L3**

Module -4

8086 Bus Configuration and Timings:
Physical memory Organization, General Bus operation cycle, I/O addressing capability, Special processor activities, Minimum mode 8086 system and Timing diagrams, Maximum Mode 8086 system and Timing diagrams. (1.4 to 1.9 of Text).

Basic Peripherals and their Interfacing with 8086 (Part 1): Static RAM Interfacing with 8086 (5.1.1), Interfacing I/O ports, PIO 8255, Modes of operation – Mode-0 and BSR Mode, Interfacing simple switches and simple LEDs using 8255 (Refer 5.3, 5.4, 5.5 of Text). **L1, L2, L3**

Module 5
Basic Peripherals and their Interfacing with 8086 (Part 2): Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255 (5.6.1, 5.7.2, 5.8). Timer 8254 – Mode 0 & 3 and Interfacing programmes for these modes (refer 6.1 of Text). **INT 21H DOS Function calls** - for handling Keyboard and Display (refer Appendix-B of Text). Von-Neumann & Harvard CPU architecture and CISC & RISC CPU architecture (refer Reference Book 1). **L1, L2, L3**

Course Outcomes: At the end of the course students will be able to:

- Explain the History of evaluation of Microprocessors, Architecture and instruction set of 8086, CISC & RISC, Von-Neumann & Harvard CPU Architecture, Configuration & Timing diagrams of 8086 and Instruction set of 8086.

- Write 8086 Assembly level programs using the 8086 instruction set

- Write modular programs using procedures.

- Write 8086 Stack and Interrupts programming.

- Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors.

- Use INT 21 DOS interrupt function calls to handle Keyboard and Display.

Text Book:
   Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2012, ISBN 978-1-25-900613-5.

Reference Books:
   1. **Microprocessor and Interfacing**- Douglas V Hall, SSSP Rao, 3rd edition TMH, 2012.
   2. **Microcomputer systems-The 8086 / 8088 Family** – Y.C.   Liu and A. Gibson, 2nd edition, PHI -2003.
   3. **The 8086 Microprocessor: Programming & Interfacing the PC** – Kenneth J Ayala, CENGAGE Learning, 2011.
   4. **The Intel Microprocessor, Architecture, Programming and Interfacing** - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

MICROPROCESSOR LAB			
SEMESTER – IV (EC/TC)			
[As per Choice Based Credit System (CBCS) Scheme]			
Laboratory Code	**17ECL47**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**01Hr Tutorial (Instructions) + 02 Hours Laboratory**	**SEE Marks**	**60**
RBT Level	**L1, L2, L3**	**Exam Hours**	**03**
CREDITS – 02			

Course objectives: This course will enable students to:
- Get familiarize with 8086 instructions and DOS 21H interrupts and function calls.
- Develop and test assembly language programs to use instructions of 8086.
- Get familiarize with interfacing of various peripheral devices with 8086 microprocessor for simple applications.

Laboratory Experiments:

1. Programs involving:

Data transfer instructions like:
i) Byte and word data transfer in different addressing Modes
ii) Block move (with and without overlap)
iii) Block interchange

2. Programs involving:

Arithmetic & logical operations like:
i) Addition and Subtraction of multi precision nos.
ii) Multiplication and Division of signed and unsigned Hexadecimal nos.
iii) ASCII adjustment instructions.
iv) Code conversions.

3. Programs involving:

Bit manipulation instructions like checking:
i) Whether given data is positive or negative
ii) Whether given data is odd or even
iii) Logical 1's and 0's in a given data
iv) 2 out 5 code
v) Bit wise and nibble wise palindrome

4. Programs involving:

Branch/ Loop instructions like

i) Arrays: addition/subtraction of N nos., Finding largest and smallest nos., Ascending and descending order.
ii) Two application programs using Procedures and Macros (Subroutines).

5. Programs involving

String manipulation like string transfer, string reversing, searching for a string.

6. Programs involving

Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console.

7. Interfacing Experiments:

Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output - PCI bus compatible card / 8086 Trainer)

1. Matrix keyboard interfacing
2. Seven segment display interface
3. Logical controller interface
4. Stepper motor interface
5. ADC and DAC Interface (8 bit)
6. Light dependent resistor (LDR), Relay and   Buzzer Interface to make light operated switches

Course Outcomes: On the completion of this laboratory course, the students will be able to:

- Write and execute 8086 assembly level programs to perform data transfer, arithmetic and logical operations.
- Understand assembler directives, branch, loop operations and DOS 21H Interrupts.
- Write and execute 8086 assembly level programs to sort and search elements in a given array.
- Perform string transfer, string reversing, searching a character in a string with string manipulation instructions of 8086.
- Utilize procedures and macros in programming 8086.
- Demonstrate the interfacing of 8086 with 7 segment display, matrix keyboard, logical controller, stepper motor, ADC, DAC, and LDR for simple applications.

Conduct of Practical Examination:
- All laboratory experiments are to be included for practical examination.
- For examination, one question from software and one question from hardware interfacing to be set.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

LINEAR ICS AND COMMUNICATION LAB **SEMESTER – IV (EC/TC)** **[As per Choice Based Credit System (CBCS) Scheme]**				
Laboratory Code	**17ECL48**	**CIE Marks**		**40**
Number of Lecture Hours/Week	**01Hr Tutorial (Instructions) + 02 Hours Laboratory**	**SEE Marks**		**60**
RBT Level	**L1, L2, L3**	**Exam Hours**		**03**
CREDITS – 02				

Course objectives: This laboratory course enables students to:
- Design, Demonstrate and Analyze instrumentation amplifier, filters, DAC, adder, differentiator and integrator circuits, using op-amp.
- Design, Demonstrate and Analyze multivibrators and oscillator circuits using Op-amp
- Design, Demonstrate and Analyze analog systems for AM, FM and Mixer operations.
- Design, Demonstrate and Analyze balance modulation and frequency synthesis.
- Demonstrate and Analyze pulse sampling and flat top sampling.

Laboratory Experiments:

1. Design an instrumentation amplifier of a differential mode gain of 'A' using three amplifiers.

2. Design of RC Phase shift and Wien's bridge oscillators using Op-amp.

3. Design active second order Butterworth low pass and high pass filters.

4. Design 4 bit R – 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.

5. Design Adder, Integrator and Differentiator using Op-Amp.

6. Design of Monostable and Astable Multivibrator using 555 Timer.

7. Demonstrate Pulse sampling, flat top sampling and reconstruction.

8. Amplitude modulation using transistor/FET (Generation and detection).

9. Frequency modulation using IC 8038/2206 and demodulation.

10. Design BJT/FET Mixer.

11. DSBSC generation using Balance Modulator IC 1496/1596.

12. Frequency synthesis using PLL.

Course Outcomes: This laboratory course enables students to:

- Illustrate the pulse and flat top sampling techniques using basic circuits.
- Demonstrate addition and integration using linear ICs, and 555 timer operations to generate signals/pulses.
- Demonstrate AM and FM operations and frequency synthesis.
- Design and illustrate the operation of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.

Conduct of Practical Examination:
- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.