Syllabus

(With effect from 2015-16 Academic year)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕವರ್ಷ 2015–16)

III & IV Semester

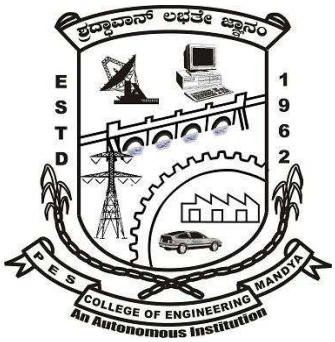
Bachelor Degree

in

Electronics and Communication Engineering

Out Come Based Education with Choice Based Credit System

ಫಲಿತಾಂಶ ಆಧಾರಿತ ಶಿಕ್ಷಣ ಹಾಗೂ ಐಚ್ಛಿಕ ವಿಷಯಾಧಾರಿತ ಗಳಿಕೆ ಪದ್ಧತಿ



P.E.S. College of Engineering, Mandya - 571 401, Karnataka

(An Autonomous Institution Affiliated to VTU, Belagavi)
Grant -in- Aid Institution
(Government of Karnataka)
Accredited by NBA, New Delhi
Approved by AICTE, New Delhi.

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ

(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

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Preface

PES College of Engineering, Mandya, started in the year 1962, has become autonomous in the academic year 2008-09. Since, then it has been doing the academic and examination activities successfully. The college is running Eight undergraduate and Eight Postgraduate programs. It consists of Six M.Tech programs, which are affiliated to VTU. Other postgraduate programs are MBA and MCA.

India has recently become a Permanent Member by signing the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degree globally but also establishes equivalence to our degrees with that of the member nations such as Taiwan, Hong Kong, Ireland, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, Australia, Canada and Japan. Among other signatories to the international agreement are the US and the UK. Implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the countries.

Our Higher Educational Institution has adopted the CBCS based semester structure with OBE scheme and grading system.

The credit based OBE semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.

The OBE, emphasize setting clear standards for observable, measurable outcomes of programs in stages. There lies a shift in thinking, teaching and learning processes moving towards Students Centric from Teacher Centric education. OBE standards focus on mathematics, language, science, attitudes, social skills & moral values.

The key features which may be used to judge, if a system has implemented an outcome based education system is mainly Standard based assessments that determines whether students have achieved the stated standard. Assessments may take any form, so long as the process actually measure whether the student knows the required information or can perform the required task. Outcome based education is a commitment that all students of all groups will ultimately reach the same minimum standards. Outcome Based Education is a method or means which begins with the end in mind and constantly emphasizes continuous improvement.

Choice Based Credit System (CBCS) provides choice for students to select from the prescribed courses (core, Foundation, Foundation Elective, elective, open elective and minor or soft skill courses). The CBCS provides a 'cafeteria' type approach in which the students can Choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach to learning which enables integration of concepts, theories, techniques, and, perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline. These greatly enhance the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills and Personality Development modules have been added to the existing curriculum of the academic year 2015-16. Industry Interactions have been made compulsory to enhance the field experience. In order to enhance creativity and innovation Mini Project and Industrial visit & Interaction are included in all undergraduate programs

Dr. Umesh D R
Deputy Dean (Academic)
Associate Professor,
Dept. of Computer Science & Engg

Dr.P S Puttaswamy
Dean (Academic)
Professor,
Dept. of Electrical & Electronics Engg..

Department of Electronics and Communication Engineering

About the department:

The department of Electronics and Communication Engineering was incepted in the year 1967 with an undergraduate program in Electronics and Communication Engineering. Initially program had an intake of 60 students and presently 150 students graduate every year. The long journey of 50 years has seen satisfactory contributions to the society, nation and world . The alumni of this department has strong global presence making their alma mater proud in every sector they represent.

Department has started its PG program in the year 2012 in the specialization of VLSI design and Embedded systems. Equipped with qualified and dedicated faculty department has focus on VLSI design, Embedded systems and Image processing. The quality of teaching and training has yielded high growth rate of placement at various organizations. Large number of candidates pursuing research programs (M.Sc/Ph D) is a true testimonial to the research potential of the department.

Vision:

The department of E & C would endeavour to create a pool of Engineers who would be **extremely competent technically, ethically strong** also fulfil their obligation in terms of **social responsibility**.

Mission

- **M1:** Adopt the best pedagogical methods and provide the best facility, infrastructure and an ambience conducive to imbibe technical knowledge and practicing ethics.
- **M2**:Group and individual exercises to inculcate habit of analytical and strategic thinking to help the students to develop creative thinking and instil team skills
- **M3**:MoUs and Sponsored projects with industry and R & D organizations for collaborative learning
- **M4**:Enabling and encouraging students for continuing education and moulding them for life-long learning process

Program Educational objectives (PEOs)

The Bachelor of Engineering (BE) program in ECE during four year term, aims at:

PEO1: Graduates to exhibit knowledge in mathematics, engineering fundamentals applied to Electronics and Communication Engineering for professional achievement in industry, research and academia

PEO2: Graduates to identify, analyse and apply engineering concepts for design of Electronics and Communication Engineering systems and demonstrate multidisciplinary expertise to handle societal needs and meet contemporary requirements

PEO3: Graduates to perform with leadership qualities, team spirit, management skills, attitude and ethics need for successful career, sustained learning and entrepreneurship.

Program Specific Outcomes (PSOs):

Program Specific Outcomes of bachelor degree (B.E, E&C) program are defined as follows which are in line with the Program specific criteria (PSC) as defined by IEEE.

After the graduation, the student will have:

1. An ability to **understand the basic concepts** in Electronics & Communication Engineering and to **apply them in the design and implementation** of Electronics and communication systems.
2. An ability to **solve complex problems** in Electronics and Communication Engineering, using latest **hardware and software tools**, along with **analytical skills** to arrive at appropriate solutions.

Scheme of Teaching and Examination - III semester B.E. (ECE)

Sl. No.	Course Code	Course Title	Teaching Dept.	Hrs/Week L:T:P:H	Total Credit	Examination Marks		
						CIE	SEE	Total
1.	P17MAT31	Engineering Mathematics-III (CC-1)	Maths	3:2:0:5	4	50	50	100
2.	P17EC32	Analog Electronic Circuits (CC-2)	ECE	4:0:0:4	4	50	50	100
3.	P17EC33	Digital Electronic Circuits (CC-3)	ECE	4:0:0:4	4	50	50	100
4.	P17EC34	Electronic Instrumentation (CC-4)	ECE	4:0:0:4	4	50	50	100
5.	P17EC35	Network Analysis & Synthesis (CC-5)	ECE	4:0:0:4	4	50	50	100
6.	P17EC36	Signals and Systems (CC-6)	ECE	2:2:0:4	3	50	50	100
7.	P17ECL37	Digital circuits design laboratory	ECE	0:0:3:3	1.5	50	50	100
8.	P17ECL38	Analog Electronics laboratory	ECE	0:0:3:3	1.5	50	50	100
9	P17HU**DIP**39	Comprehensive Communication Development(CCD)	HS & M	2:0:0:2	[2]	[50]	[50]	[100]
10	P17HU39	**Aptitude and Reasoning Development - BEGINNER (ARDB)	HS&M	2:0:0:2	0	(50)	--	--
12	P17HM**DIP**310	* Indian Constitution, Human Rights & Professional Ethics	Human& Science	2:0:0:2	0	--	---	---
13	P17MA**DIP**31	*Additional Maths-I	Maths	4:0:0:4	0	--	---	---
Total					26 [28]	400 [450]	400 [450]	800 [900]

* Additional Mathematics-I & Constitution of India and Professional Ethics : Lateral entry students shall have to pass these mandatory learning courses before completion of VI- Semester

** ARDB: All students shall have to pass this mandatory learning courses before completion of VI- Semester

Scheme of Teaching and Examination IV Semester B.E. (ECE)

Sl. No.	Course Code	Course Title	Teaching Dept.	Hrs/ Week L:T:P:H	Total Credit	Examination Marks		
						CIE	SEE	Total
1.	P17MAES41^{++}	Engineering Mathematics-IV (CC-1)	Maths	3:2:0:5	4	50	50	100
2.	P17EC42	Analog and Digital Communication(CC-2)	ECE	4:0:0:4	4	50	50	100
3.	P17EC43	Digital Design Using Verilog HDL (CC-3)	ECE	4:0:0:4	4	50	50	100
4.	P17EC44	Digital Signal Processing(CC-4)	ECE	4:0:0:4	4	50	50	100
5.	P17EC45	Microcontroller(CC-5)	ECE	4:0:0:4	4	50	50	100
6.	P17EC46	Electromagnetic Field Theory(CC-6)	ECE	4:0:0:4	3	50	50	100
7.	P17ECL47	Microcontroller Laboratory	ECE	0:0:3:3	1.5	50	50	100
8.	P17ECL48	Digital Design Using Verilog HDL Laboratory	ECE	0:0:3:3	1.5	50	50	100
9	P17HU49	Aptitude and Reasoning Development – Intermediate (ARDI)	HS&M	2:0:0:2	1	50	50	100
10	P17MA**DIP**41	*Additional Maths-II	Maths	4:0:0:4	0	--	--	--
11	P17EV**DIP**410	*Environmental Studies	ENV	2:0:0:2	0	--	--	--
Total					27	450	450	900

* Additional Mathematics-II & Environmental Studies: Lateral entry students shall have to pass these mandatory learning courses before completion of VI- Semester

Course Title: ENGINEERING MATHEMATICS-III(Common to All Branches)			
Course Code: P17MA31	**Semester: III**	**L – T – P – H : 3– 2 – 0 – 5**	**Credits:4**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %; SEE: 50%**	

Prerequisites: The student should have acquired the knowledge of Engineering Mathematics-I & II of I and II semester B.E.

Course Learning Objectives (CLOs):

The course P17MA31 aims to:

1. Describe the concepts of elementary numerical analysis such as forward/backward finite differences, central differences, interpolation and extrapolation formulae, techniques of numerical differentiation and integration.
2. Explain the nature of periodic functions Fourier series of general as well as even /odd functions valid in full range/half-range periods along with applications through practical harmonic analysis.
3. Learn modeling in terms of partial differential equations and also, learn different exact/analytical methods of solving with special emphasis on interpretation of the solution of one-dimensional wave, heat and Laplace equations with given initial and boundary conditions in the context of various engineering and technological applications.

Relevance of the course:

- Engineering Mathematics-III deals with the Numerical methods to solve interpolation and extrapolation problems in engineering field.
- In Fourier series analyze engineering problems arising in control theory and fluid flow phenomena using harmonic analysis
- Analyze the engineering problems arising in signals and systems, digital signal processing using Fourier transform techniques.
- Z-transforms & Z-transforms of standard functions to solve the specific problems by using properties of Z-transforms.
- Identify and solve difference equations arising in engineering applications using inverse Z–transforms techniques
- Partial Differential Equations (PDE's), order, degree and formation of PDE's and, to solve PDE's by various methods of solution.
- One – dimensional wave and heat equation and Laplace's equation and physical significance of their solutions to the problems selected from engineering field

Course Content

UNIT-I

Numerical Methods-I: Finite differences**:** Forward and Backward differences, Gregory-Newton forward and backward interpolation formulae, Newton's divided difference formula, Lagrange's interpolation formula and inverse interpolation formula. (All formulae without proof) – Problems only

Central differences: Gauss Forward and Backward difference formulae, Sterling's, and Bessel's formulae (All formulae without proof) – problems.

Self-Study Component: Problems using Everett's formula in Central differences **10 Hrs**

UNIT-II

Numerical differentiation using Newton's forward and backward interpolation formulae, Newton's divided difference formula and Sterling's formula (All formulae without proof)- problems only and Applications to Maxima and Minima of a tabulated function.

Numerical integration: Newton- Cotes quadrature formula, Trapezoidal rule, Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule, Boole's rule and Weddle's rule (All rules without proof)- Illustrative problems.

Self-Study Component: Derive Newton- Cotes quadrature formula. **10 Hrs**

UNIT-III

Fourier series: Periodic functions, Fourier series- Euler's formula, Dirichlet's conditions. Fourier series of discontinuous functions, Fourier series of even and odd functions. Change of interval- Fourier series of functions of arbitrary period. Half–range Fourier series expansions, Fourier series in complex form, Practical harmonic analysis- Illustrative examples from engineering field.

Self-Study Component: Derivations of Euler's formulae **11 Hrs**

UNIT-IV

Fourier Transforms: Infinite Fourier transforms-properties. Fourier sine and Fourier cosine transforms, properties. Inverse infinite Fourier and inverse Fourier sine & cosine transforms – Illustrative examples.

Difference equations and Z-transforms: Definition of Z-transforms- standard Z-transforms, linearity property, damping rule, shifting rules, initial value theorem and final value theorem (All rules and theorems without proof). Inverse Z – transforms. Difference equations- basic definitions. Application of Z-transforms to solve difference equations.

Self-Study Component: Convolution theorem, Parseval's identities.related problems. **10 Hrs**

UNIT-V

Partial differential equations (PDE's):

Formation of PDE's. Solution of non-homogeneous PDE by direct integration. Solutions of homogeneous PDE involving derivative with respect to one independent variable only (both types with given set of conditions). Method of separation of variables (first and second order equations). Solution of the Lagrange's linear PDE's of the type: $Pp + Qq = R$.

Applications of PDE's:

One- dimensional wave and heat equations (No derivation), and various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional

Laplace's equation (No derivation)–various possible solutions. Solution of all these equations with specified boundary conditions (Boundary value problems). Illustrative examples from engineering field.

Self-Study Component: Finding the solution of non-linear equations of first order: Charpit's Method -simple problem. **11 Hrs**

Text Books:

1. Higher Engineering Mathematics: B.S. Grewal, Khanna Publishers, New Delhi, 42nd Ed. 2012.

2. Advanced Engineering Mathematics: - E. Kreyszig, John Wiley & Sons, 6^{th} Ed.2007.

References:

1. Advanced Modern Engineering Mathematics: - Glyn James, Pearson Education Ltd., 3rd Ed., 2007.
2. Advanced Engineering Mathematics: Peter V O' Neil Thomson, Brooks/Cole, 5th edition, 2007.
3. Higher Engineering Mathematics: - B.V. RAMANA, McGraw Hill Education, 2007

Note: - Each unit contains ***two*** full questions of ***20 marks*** each. Students are required to Answer ***five*** full questions choosing at least ***one*** question from each unit.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to;

1. Apply forward, backward difference formulae and central differences formulae in solving interpolation- extrapolation problems in engineering field.
2. Apply Numerical differentiation and integration rules in solving engineering where the handling of numerical methods is inevitable.
3. Recognize the importance of Fourier series & Fourier transforms, difference equations and Z-transforms in the field of signals and systems, communication and network theory signal and image processing, control theory, flow & heat transfer and theory of elasticity.
4. Learn modeling in terms of partial differential equations and also, learn different exact/analytical methods of solving with special emphasis on interpretation of the solution.
5. Interpret the solution of one-dimensional wave, heat and Laplace equations with given initial and boundary conditions in the context of various engineering and technological applications.

Course Articulation Matrix (CAM)

CO's	Title : Engineering Mathematics –III											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO-1	1	**2**	-	-	-	-	-	-	-	-	-	-
CO-2	**2**	**2**	-	-	-	-	-	-	-	-	-	-
CO-3	**3**	**3**	-	-	-	-	-	-	-	-	-	-
CO-4	**2**	**3**	-	-	-	-	-	-	-	-	-	-
CO-5	**2**	**3**	-	-	-	-	-	-	-	-	-	-

A. Course Plan - Core			
Course Title: **Analog Electronic Circuits**			
Course Code: **P17EC32**	Semester: **III**	L – T – P : 4 – 0 - 0	Credits: 4
Contact Period- Lecture:52Hrs.; Exam:3 Hrs.		Weightage: CIE: 50%; SEE: 100%	

B. Course Learning Objectives (CLOs):

This Course aims at;

1. Providing the basic knowledge of N-MOSFET, P-MOSFET, device structure, MOSFET circuit at DC, MOSFET as an amplifier and as a switch.
2. Understanding MOSFET biasing , amplifier circuits, small signal operations and models, frequency response of CS amplifier.
3. Providing understanding of basic operation of Op–Amp and its operation as DC and AC amplifiers.
4. Understanding various applications of Op-Amp like inverting amplifier, non–inverting amplifier, voltage follower, summing amplifier and difference amplifier.
5. Understanding voltage sources, current sources and current amplifiers.
6. Explaining the Op–Amp frequency response, compensation and applications.
7. Understanding the operation of Op Amp based differentiating, integrating and Schmitt trigger circuits.
8. Knowing various applications of 555 timer such as rectifiers, clippers, clampers, monostable and astable multi–vibrators
9. Knowing use of Op–Amps in signal generators, filters & regulators and designing filters
10. Understanding use of Op-Amps in DC voltage regulators.

C.Course Content

UNIT-I

MOS Field – Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation, Current – Voltage Characteristics, MOSFET Circuits at DC, The MOSFET as an Amplifier and as a Switch, Biasing in MOS Amplifier Circuits, Small Signal Operation and Models, Basic MOSFET amplifier configurations – The three basic configurations, Characterizing Amplifiers, The Common Source Amplifier, Frequency Response of the CS Amplifier.

Text 1: 4.1 to 4.1.9, 4.2 to 4.2.5, 4.3 to 4.6, 4.7 to 4.7.3, 4.9.1. 10 Hrs

UNIT-II

Operational Amplifier Fundamentals: IC Operational amplifiers, Op–Amp parameters – Input, output and supply voltages, 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, Direct–Coupled Non–inverting Amplifiers, Direct–Coupled Inverting amplifiers, Summing amplifiers, Difference amplifier.

Op–Amps as AC Amplifiers: Capacitor coupled Voltage Follower, High input impedance – Capacitor coupled Voltage Follower, Capacitor coupled Non–inverting Amplifiers, Capacitor coupled Inverting amplifiers, setting the upper cut–off frequency, Capacitor coupled Difference amplifier, Use of a single polarity power supply.

Text 2: 1.1, 2.3, 2.4, 2.5, 2.6, 3.1, 3.2, 3.3, 3.4, 3.6, 3.7. 4.1 to 4.3, 4.5 to 4.8. 11 Hrs

UNIT-III

Op–Amps frequency response and compensation: Circuit stability, Frequency compensation methods, Circuit Band width and Slew rate, circuit stability precautions. **OP–AMP Applications:** Voltage sources, current sources, Current amplifiers, voltage level detectors, inverting Schmitt trigger circuits Differentiating Circuit, Integrating Circuit.

Text 2: 5.1, 5.2, 5.4, 5.6, 7.1, 7.2, 7.3, 8.2, 8.3, 8.6, 8.7. 10 Hrs

UNIT-IV

Signal Processing Circuits: Precision Half–Wave Rectifiers: Saturating Precision Rectifier and Nonsaturating Precision Rectifier, Precision Full–Wave Rectifiers, Limiting circuits: Peak Clipper and Dead Zone Circuit, Clamping circuits, Peak detectors, Sample and Hold circuits, Astable Multivibrator using op-amp, Astable and Monostable Multivibrator using 555 timer.

Text 2: 9.1 to 9.6, 10.1, 10.6, 10.7. 10 Hrs

UNIT-V

Signal Generators: Triangular wave generators, Phase shift and Quadrature Oscillators, Colpitts and Hartley Oscillators, Active Filters –Filter types and characteristics, First and Second order Low pass & High pass filters.

DC Voltage Regulators: Voltage Regulator Basics, Op–amp series voltage Regulator, Adjustable Output Regulators, Output Current Limiting, Integrated Circuit linear Voltage Regulators: 723, LM317and LM337 IC Regulators.

Text 2: 10.3, 11.1, 11.2, 12.1, 12.2, 12.3, 13.1, 13.2, 13.3, 13.4, 13.5 11 Hrs

Self Learning Components

Unit-I	1. MOSFET fabrication process. 2. Multi stage amplifiers using MOSFET
Unit II	1.Simulation of different amplifiers (single, Dual, Quad etc) using any circuit Simulator.
Unit III	1. Simulation of Schmitt trigger using simulator. 2. Simulation of integrating and Differentiating circuits using simulator
Unit IV	1. Simulation of Op-amp applications like Rectifiers, Clippers, Clampers etc using simulator. 2. Applications of Multivibrator
Unit V	1. Study of Band pass and Band reject filter. 2. Different Voltage Regulators using IC (Except LM317,LM337,723).

Note: No questions set from SLC in the SEE paper

TEXT BOOKS:

1. **"Microelectronic Circuits Theory and Applications",** Adel S. Sedra, Kenneth C. Smith Adapted by Arun N. Chandorkar, 6th Edition International Version, Oxford. University Press (2013) ISBN 10: 0198089139 ISBN 13: 9780198089131
2. **"Operational Amplifiers and Linear IC's"**, David A. Bell, 3rd edition, Oxford university Press, 2011. ISBN-13: 978-0-19-569613-4 ISBN-10: 0-19-569613-1

REFERENCE BOOKS:

1. **"Electronic devices and circuit theory**" Robert L. Boylestad and Louis Nashelsky, pearson 10th edition. ISBN: 9789332542600/9788131727003, 8131727009 (for self learning component).
2. **"Linear Integrated Circuits**", D. Roy Choudhury and Shail B. Jain, 2nd edition, Reprint 2006, New Age International. ISBN: 9788122430981, 8122430988
3. **"Op – Amps and Linear Integrated Circuits**", Ramakant A. Gayakwad, 4th edition, PHI. ISBN: 9788120320581, 8120320581

D. Course Outcome

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	**Apply** the knowledge of physics to describe the operation and characteristics of MOSFETs and Op-Amps.	**PO1, [L3]**
CO2	**Analyze** the frequency response, stability and applications of MOSFETs and op-amps.	**PO2, [L3]**
CO3	**Design** the biasing circuits for MOSFETs and op-amps for given specifications.	**PO3, [L4]**
CO4	**Design** the op-amp amplifiers, op-amp voltage sources, and current sources, op-amp Schmitt trigger circuits, precision rectifiers, waveform generators, op-amp oscillators, filters, op-amp voltage regulator and other op-amp applications for a given specifications.	**PO3, [L4]**
CO5	To **Analyse** the MOSFET and Op-am circuits using any circuit simulator in a group.	**PO5, PO9, [L3]**

E. Course Articulation Matrix (CAM)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
#1	**2**												**2**	
#2		**3**												**3**
#3			**2**											**3**
#4			**3**											**3**
#5					**2**				**2**					**3**

A. Course Plan - Core			
Course Title: **Digital Electronic Circuits**			
Course Code: **P17EC33**	Semester: **III**	L – T – P : 4– 0 - 0	Credits: 4
Contact Period -Lecture: 52Hrs.;Exam: 3Hrs.		Weightage: CIE: 50 %;	SEE:50%

B. Course Learning Objectives (CLOs)

This Course aims to;

1. Explain the concept of logic families like DTL, TTL and ECL.
2. Discuss the following concepts for designing a logic circuit: Boolean algebra, K–map, SOP and POS equations, minters, maxterms, QM method and VEM technique.
3. Design and implement the arithmetic circuit, comparators, decoders, encoders, MUX, DEMUX, and PLD's.
4. Provide the understanding of timing diagram and internal structure of various flip–flops (RS, JK, D and T).
5. Design and implement the sequential circuits like registers and counters.
6. Describe Datapath and ALU Design.

C. Course Content

UNIT – I

Classification of Integrated Circuits: Gate performance considerations, Diode transistor logic (DTL), Transistor– Transistor logic(TTL), Emitter Coupled Logic(ECL), MOS field –effect Transistor , NMOS and PMOS logic ,CMOS logic.

Text 1: A.5, A.6, A.7, A.8, A.9, A.10, A.11 **10 Hrs**

UNIT – II

Boolean algebra and Combinational Networks: Canonical formulas, Manipulation of Boolean Formulas.

Text 1: 3.5, 3.6

Simplification of Boolean Expressions-I: Formulation of the simplification problem, Prime Implicants and Irredundant Disjunctive Expressions, Prime Implicates and Irredundant conjunctive Expressions, Karnaugh Maps, Using Karnaugh Maps to Obtain Minimal Expressions for Complete Boolean functions, Minimal Expressions of Incomplete Boolean functions.

Text 1: 4.1 - 4.6

Simplification of Boolean Expressions-II: TheQuine – McCluskey Method of Generating Prime Implicants and Prime Implicates, Prime Implicant/Prime Implicate Tables and Irredundant Expressions, Prime Implicant/Prime Implicate Table Reductions, Variable Entered Karnaugh Maps.

Text 1: 4.8-4.10, 4.14 **11Hrs**

UNIT – III

Logical Design with MSI Components and Programmable Logic Devices-I: Binary Adders and Subtractors, Comparators, Decoders, Encoders.

Logical Design with MSI Components and Programmable Logic Devices-II: Multiplexers, Programmable Logic Devices, PROMS, Programmable Logic Arrays.

Text 1: 5.1, 5.2-5.9 **11 Hrs**

UNIT – IV

Flip-Flops and Simple Flip-Flop Applications-I: Basic Bi–stable Element, Latches, SR Latch, Application of SR Latch, A Switch De–bouncer, The SRLatch, The gated SR Latch, The gated D Latch, The Master–Slave Flip–Flops (Pulse–Triggered Flip–Flops): The Master–Slave SR Flip–Flops, The Master–Slave JK Flip–Flop, Edge Triggered Flip–Flop: The Positive Edge–Triggered D Flip–Flop, Negative–Edge Triggered D Flip–Flop.

Text 1: 6.1, 6.2, 6.4, 6.5 **10Hrs**

UNIT – V

Flip-Flops and Simple Flip-Flop Applications-I: Characteristic Equations, Registers, Counters – Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod–6 Counter using clocked JK Flip–Flops, Design of a Synchronous Mod–6 Counter using clocked D, T, or SR Flip–Flops.
Text 1: 6.6, 6.7, 6.8, 6.9 – 6.9.1 and 6.9.2.
Computer Design Basics: Introduction, Dataptahs, The Arithmetic/Logic Unit.
Text 2: pp.509-519. **10Hrs**

TEXT BOOKS:

1. **"Digital Principles and Design",** Donald D Givone , Tata McGraw Hill, 2002. ISBN: 978-0-07-052906-9.
2. **"Logic and computer design Fundamentals",** Mano and Kim, Pearson, Fourth edition, 2008.ISBN: 978-9332518728.

REFERENCE BOOKS:

1. **"Fundamentals of logic design",** Charles H Roth Jr, Thomson Learning, 2004. ISBN: 978-8131500439.
2. **"Introduction to Digital System",** Tomas Lang, Jaime H Moreno, Milos Ercegovac, John Wiley, 2005. ISBN: 978-0471527992.

Self Learning Component:
Implementation of Digital circuits discussed in the syllabus using any EDA tools as specified by Teacher

D. Course Outcomes

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	Ability to **apply** the knowledge of mathematics and science to understand the operation of logic circuits and performance parameters	PO1 (L1,L2)
CO2	Ability to apply the simplification techniques/methods to **optimize and implement** the digital functions/circuits	PO2,PO3 (L3,L4)
CO3	Ability to **analyze** the given logic circuit based on the knowledge of digital elements	PO2 (L3)
CO4	Ability to **design** a combinational and sequential logic circuit for the given requirements/specifications	PO3 (L4)
CO5	Ability to **understand** the datapath and design of ALU	PO1 (L1,L2)

E. Course Articulation Matrix (CAM)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
#1	**3**												**3**	
#2		**2**	**2**											**2**
#3		**3**												**3**
#4			**3**											
#5	**1**	**2**											**2**	

A. Course Plan - Core			
Course Title :**Electronic Instrumentation**			
Course Code: **P17EC34**	Semester : **III**	L-T-P: 4 – 0 - 0	Credits: 4
Contact Period : Lecture :52 Hr, Exam: 3Hr		Weight age: CIE:50% SEE:50%	

B. Course Learning Objectives (CLOs)

This course aims to

1. Define and explain various errors.
2. Explain the basic construction of Voltmeters and Multimeters.
3. Sketch the circuit diagram of a Wheatstone bridge, explain its operation, derive its balance equations, and calculate resistor values from the bridge component at balance.
4. Show how a linear variable differential transducer produces an ac output voltage with amplitude and phase dependent upon the displacement of the core.
5. Explain the operation of a photodiode, Sketch its characteristics.
6. Draw spectrum analyser displays for various input waveforms.
7. Using illustrations, explain the operation of analog storage oscilloscopes, and discuss their applications.
8. Sketch the basic circuit for a square/triangular waveform function generator. Explain how square and triangular waveforms are generated, and how the output frequency is adjusted.

C. Course Content

UNIT – I

Qualities of Measurements: Introduction, Performance Characteristics, Static Characteristics, Error in Measurement, Types of Static Error, Sources of Error, Dynamic Characteristics.

Voltmeters and Multimeters: Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multirange Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter Using Rectifiers, AC Voltmeter Using Half Wave Rectifier, AC Voltmeter Using Full Wave Rectifier, Peak Responding Voltmeter, True RMS Voltmeter.

Digital Voltmeters: Introduction, RAMP Technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly Used Principles of ADC, Successive Approximations, 3½ Digit, Resolution and Sensitivity of Digital Meters.

Text 1: 1.1 to 1.7, 4.1 to 4.6, 4.12 to 4.14, 4.17, 4.18, 5.1 to 5.6, 5.8, 5.9 **11 Hrs**

UNIT – II

Bridges: Introduction, Wheatstone's Bridge, Kelvin's Bridge, Practical Kelvin's Double Bridge, AC Bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's Bridge, Hay's Bridge, Schering's Bridge, Wein's Bridge, Wagner's Earth Connection, Precautions to be Taken when Using a Bridge.

Text 1: 11.1 to 11.4, 11.8 to 11.15, 11.23 **10 Hrs**

UNIT – III

Transducers: Introduction, Electrical Transducer, Selecting a Transducer, Resistive Transducer, Resistive Position Transducer, Strain Gauges, Resistance Thermometer, Thermistor, Inductive Transducer, Differential Output Transducers, Linear Variable Differential Transducer, Piezo

Electrical Transducer, Piezo Electric Transducer, Photo-Voltaic Cell, Semiconductor Photo Diode, The Photo-Transistor.
Text 1: 13.1 to 13.11, 13.15 to 13.19 **11 Hrs**

UNIT – IV

Wave Analyzers and Harmonic Distortion: Introduction, Basic Wave Analyzer, Frequency Selective Wave Analyzer, Heterodyne Wave Analyzer, Harmonic Distortion Analyzer, Spectrum Analyzer.
Signal Conditioning: Basic Instrumentation Amplifier, Applications of Instrumentation Amplifiers.
Data Acquisition System (DAS): Introduction, Objective of a DAS, Signal Conditioning of the Inputs, Single Channel Data Acquisition System, Multi-Channel DAS, Computer Based DAS.
Text 1: 9.1 to 9.6, 14.3 to 14.4, 17.1 to 17.6 **10 Hrs**

UNIT – V

Special Oscilloscopes: Delayed-time-base Oscilloscopes, Analog Storage Oscilloscope, Sampling Oscilloscope, Digital Storage Oscilloscopes, DSO Applications.
Signal Generators: Low-frequency Signal Generators, Function Generators, Pulse Generators, Sweep Frequency Generators, Frequency Synthesizer, Arbitrary Waveform Generator.
Text 2: 12.1 to 12.5, 13.1 to 13.3, 13.5 to 13.7 **10 Hrs**

TEXT BOOK:

1. **"Electronic Instrumentation"**, H. S. Kalsi, McGraw Hill, 3e, 2010. ISBN: 9780070702066
2. **"Electronic Instrumentation and Measurements",** David A. Bell, Oxford University Press, 3e, 2015, ISBN: 9780195696141

REFERENCE BOOKS:

1. **"Modern Electronic Instrumentation and Measuring Techniques",** Cooper, Helfrick, Prentice Hall of India.ISBN:9780074633502
2. **"Student Reference Manual for Electronic Instrumentation Laboratories"** Wolf, Smith, , Prentice Hall of India, 2e, 2004. ISBN: 9780130421821

Self Learning Component

1. Understand the working of Flash method ADC
2. List of companies that manufacture standard voltmeters and ammeters, their range of operation , salient features of each.
3. Understand the working of De Sauty's Bridge.
4. Understand the importance of grounding and shielding of electronic instruments.
5. List out few electronic and fibre optic sensors which work on the principal of Transducers.
6. List out the companies that manufacture oscilloscopes and signal generators and note the features of operation.
7. Gather information about data acquisition systems and its uses in fibre optic receivers.

D. Course Outcome

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	Ability to **apply** the basic knowledge of Electrical and Electronic principles in Electronic Instrumentation.	PO1(L3)
CO2	Ability to **analyse** the working principle and construction of the electronic measuring instruments.	PO2(L4)
CO3	Ability to **measure** various electrical and physical quantities and related parameters using meters and transducers.	PO1(L2)
CO4	Ability to **design** a system for the desired specifications in Electronic Instrumentation.	PO3(L4)
CO5	Ability to **understand** the working of oscilloscopes, signal generators, wave analysers and harmonic distortion analysers	PO1(L2)

E. Course Articulation Matrix (CAM)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
#1	**3**												**3**	
#2		**2**												**2**
#3	**2**												**2**	
#4			**3**											
#5	**3**												**3**	

A. Course Plan			
Course Title : **Network Analysis and Synthesis**			
Course Code: **P17EC35**	Semester : **III**	L-T-P: 4 – 0 - 0	Credits: 4
Contact Period : Lecture :52 Hr, Exam: 3Hr		Weight age: CIE:50% SEE:50%	

B. Course Learning Objectives (CLOs)

This course aims to

1. Understand electrical circuits, their sources and transformations and also their analysis and solutions through node analysis and mesh analysis methods.
2. Provide the understanding of various network theorems (ac and dc) to analyze complex circuits.
3. Explain the parameters of a tuned network like quality factor, bandwidth, and power levels at important frequency levels.
4. Analyze the transient conditions that may occur in electrical networks by solving necessary differential equations.
5. Provide explanation of Laplace transform and its application in solving circuit problems.
6. Determine transient response of electrical circuits by Laplace transform method.
7. Examine the behaviour of two-port networks and learn about few special two-port networks.
8. Demonstrate that the graph theory concept eases the solution method for solving networks with a large number of nodes and branches.
9. Illustrate the different considerations of a physically realizable system.
10. Discuss the various properties and synthesis methods for different one-port networks.

C. Course Content

UNIT -I

Circuit Analysis Techniques (DC and AC): Nodal Analysis, The Supernode, Mesh Analysis, The Supermesh, Linearity and Superposition, Source Transformations, Thévenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion.

Text 1:- 4.1 to 4.4, 5.1 to 5.5, 10.6 to 10.7, 11.1 to 11.2 **11 Hrs**

UNIT - II

Frequency Response: Parallel Resonance, Bandwidth and High-Q Circuits, Series Resonance, Scaling.

Transient Analysis: Introduction, Resistor-Inductor Circuit, Resistor-Capacitor Circuit, Resistor-Inductor-Capacitor Circuit.

Text 1:- 16.1 to 16.3, 16.5

Text 2:- 10.1 to 10.5 **10 Hrs**

UNIT - III

Circuit Analysis In The S-Domain: Complex Frequency, The Damped Sinusoidal Forcing Function, Definition of the Laplace Transform, Laplace Transforms of Simple Time Functions, Inverse Transform Techniques, Basic Theorems for the Laplace Transform, The Initial-Value and Final-Value Theorems.

Z(s) and Y(s), Poles, Zeros, and Transfer Functions, Convolution, The Complex-Frequency Plane, Natural Response and the s Plane, A Technique for Synthesizing the Voltage Ratio H(s) = V_{out}/V_{in}.

Text 1:- 14.1 to 14.7, 15.1, 15.4 to 15.8 **10 Hrs**

UNIT - IV

Two-Port Networks: One-Port Networks, Admittance Parameters, Some Equivalent Networks, Impedance Parameters, Hybrid Parameters, Transmission Parameters.

Network Topology: Introduction, Graph of a Network, Definitions Associated with a Graph, Incidence Matrix, Loop Matrix or Circuit Matrix, Cutset Matrix, Kirchhoff's Voltage Law, Kirchhoff's Current Law, Network Equilibrium Equations, Duality. .

Text 1:- 17.1 to 17.6

Text 2:- 9.1 to 9.6, 9.8, 9.9, 9.12, 9.13 **10 Hrs**

UNIT - V

Network Synthesis: Introduction, Hurwitz Polynomials, Positive Real Functions, Elementary Synthesis Concepts, Realization of LC Functions, Realization of RC Functions, Realization of RL Functions.

Text 2:- 16.1 to 16.7 **11 Hrs**

TEXT BOOKS:

1. **"Engineering Circuit Analysis",** William Hayt, Jack Kemmerly, Steven Durbin, 8e, McGraw Hill. ISBN:978-0-07-352957-8
2. **"Network Analysis and Synthesis",** Ravish R Singh, McGraw Hill. ISBN:978-1-25-906295-7

REFERENCE BOOKS:

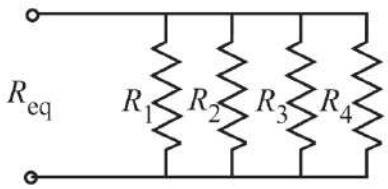
1. **"3000 Solved Problems in Electric Circuits, Schaum's Solved Problems",** Syed Nasar, McGraw Hill. ISBN:978-0070459366
2. **"Problems and Solutions in Engineering Circuit Analysis",** William Hayt, Jack Kemmerly, McGraw Hill. ISBN:978-0071333030
3. **"Electric Circuits",** Nilsson, Riedel, 10e, Pearson Education. ISBN:978-0133760033
4. **"Basic Engineering Circuit Analysis",** Irwin, Nelms, 11e, John Wiley. ISBN:978-1-118-539293
5. **"Basic Circuit Theory",** Lawrence Huelsman, 3e, Prentice Hall of India/Pearson.ISBN:9780135187210

Self Learning Component
P17EC35: Network Analysis and Synthesis
Use any EDA tools (Ex:- Multisim® / MATLAB® / Scilab, etc.,) to solve/simulate the following circuits.

Unit - I

The equivalent resistance, R_{eq}, of four resistors, R_1, R_2, R_3, and R_4, that are connected in parallel is given by:

$$R_{eq} = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4}}$$



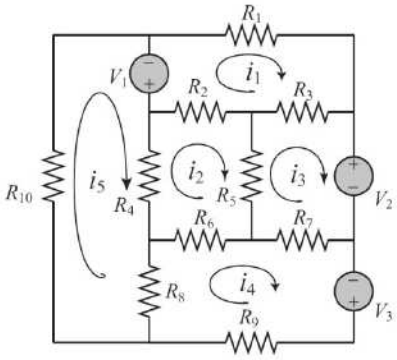
Calculate R_{eq} if $R_1 = 120\Omega$, $R_2 = 220\Omega$, $R_3 = 75\Omega$, and $R_4 = 130\Omega$.

Solve the following system of three linear equations:

$$-4x + 3y + z = -18.2$$
$$5x + 6y - 2z = -48.8$$
$$2x - 5y + 4.5z = 92.5$$

The electrical circuit shown consists of resistors and voltage sources. Determine i_1, i_2, i_3, i_4 and i_5, using the mesh current method based on Kirchhoff's voltage law

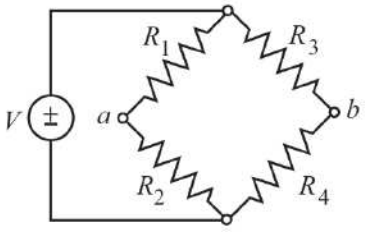
$V_1 = 40\,\text{V}$, $V_2 = 30\,\text{V}$, $V_3 = 36\,\text{V}$,
$R_1 = 16\,\Omega$, $R_2 = 20\,\Omega$, $R_3 = 10\,\Omega$
$R_4 = 14\,\Omega$, $R_5 = 8\,\Omega$, $R_6 = 16\,\Omega$,
$R_7 = 10\,\Omega$, $R_8 = 15\,\Omega$, $R_9 = 6\,\Omega$,
$R_{10} = 4\,\Omega$.



The voltage difference V_{ab} between points a and b in the Wheatstone bridge circuit is:

$$V_{ab} = V\left(\frac{R_1R_3 - R_2R_4}{(R_1+R_2)(R_3+R_4)}\right)$$

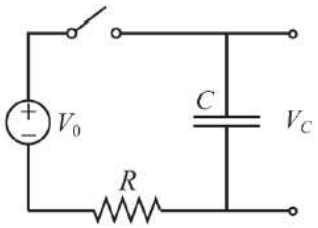
Calculate the voltage difference when $V = 14$ volts, $R_1 = 120.6$ ohms, $R_2 = 119.3$ ohms, $R_3 = 121.2$ ohms, and $R_4 = 118.8$ ohms.



Unit – II, III

The voltage V_C t seconds after closing the switch in the circuit shown is:

$$V_C = V_0(1 - e^{-t/(RC)})$$

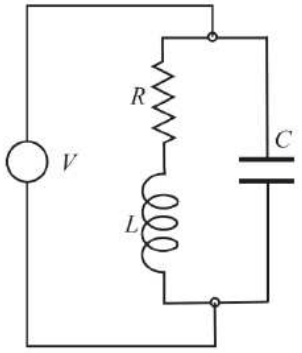


Given $V_C = 36$ V, $R = 2500\ \Omega$, and $C = 1600\ \mu$F, calculate the current 8 seconds after the switch is closed.

The resonant frequency f (in Hz) for the circuit shown is given by:

$$f = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \left(\frac{R}{L}\right)^2}$$

Calculate the resonant frequency when $L = 0.15$ henrys, $R = 14$ ohms, and $C = 2.6 \times 10^{-6}$ farads.

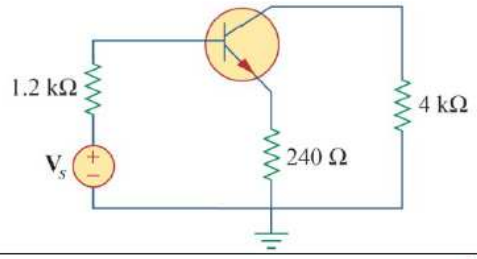


Unit - IV

Determine A_v, A_i, Z_{in}, and Z_{out} for the amplifier shown in Fig.

$h_{ie} = 4$ kΩ, $h_{re} = 10^{-4}$

$h_{fe} = 100$, $h_{oe} = 30\ \mu$S



A transistor has the following parameters in a common-emitter circuit:

$h_{ie} = 2{,}640\ \Omega$, $h_{re} = 2.6 \times 10^{-4}$

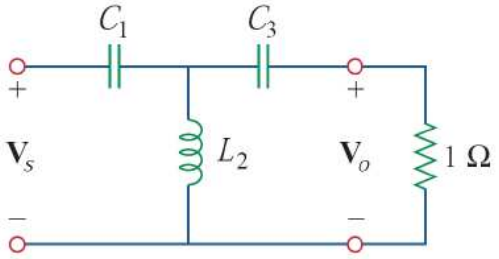
$h_{fe} = 72$, $h_{oe} = 16\ \mu$S, $R_L = 100$ kΩ

What is the voltage amplification of the transistor? How many decibels gain is this?

Unit - V

Synthesize the transfer function using the given LC ladder network.

$$H(s) = \frac{V_o}{V_s} = \frac{s^3}{s^3 + 6s + 12s + 24}$$



D. Course Outcome

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	Ability to **apply** the fundamental concepts in solving and analyzing different Electrical networks	PO1, PO2,L3
CO2	Ability to **solve** circuits using appropriate technique	PO2, PO3,L3
CO3	Ability to **apply** mathematics in analyzing and synthesizing the networks in time and frequency domain	PO3,L4
CO4	Ability to **analyze** the performance of a particular network	PO2,L4
CO5	Ability to **formulate** various synthesis methods for different one-port networks	PO3,L3

E. Course Articulation Matrix (CAM)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
#1	**3**	**2**											**3**	**2**
#2		**3**	**2**											**3**
#3			**3**											
#4		**2**												**2**
#5			**3**											
#6	**3**	**2**											**3**	**2**

A. Course Plan			
Course Title: **Signals and Systems**			
Course Code: **P17EC36**	Semester: **III**	L – T – P : 3 – 0 - 0	Credits:3
Contact Period - Lecture:52Hrs.;Exam: 3Hrs.	Weightage: CIE: 50% SEE: 50%		

B. Course Learning Objectives (CLOs):

This Course aims to;

1. Classify the signals and understand different operations on signals.
2. Recognize the basic signals (both continuous- time and discrete-time) like impulse, unit step, ramp, sinusoids and exponentials, represented both in frequency and time domains.
3. Characterize LTI system using impulse response and linear constant coefficient differential equations.
4. Implement the systems (any order) in Direct-form-I and Direct-form-II
5. Represent all types of signals (CT/DT, periodic/non-periodic) in terms of complex exponentials in time and frequency domains.
6. Represent system in terms of transfer function.
7. Understand the processes of sampling and need for correct sampling rate.
8. Understand process of reconstructing continuous time signal through its samples.
9. Transform signal from time to / fro frequency domain through Z-transform and different properties of Z-transform.
10. Define relationship between Z transform and Fourier transform.

C. Course Content

UNIT – I

Introduction, continuous time and discrete time signals, transformations of the independent variable, exponential and sinusoidal signals, the unit impulse and unit step functions, continuous-time and discrete-time systems, basic system properties.

Text1: 1.1 to 1.6 **10 Hrs**

UNIT – II

Linear time invariant systems: Introduction, Discrete-time LTI systems- The Convolution sum, Continous-time LTI systems- The Convolution integrals, properties of linear time-invariant systems, causal LTI systems described by differential and difference equations, block diagram representation of systems(Direct form-I and Direct form-II).

Text1: 2.1 to 2.4 **10 Hrs**

UNIT– III

Fourier representation of continuous-time (CT) signals: CT periodic signals: Fourier series representation of continuous-time periodic signals, Properties of continuous –Time Fourier Series.

CT non-periodic signals: Representation of Aperiodic signals: The continuous time Fourier transform, the fourier transform for periodic signals, Properties of continuous- time Fourier transform , the convolution property, the multiplication property , tables of fourier properties and

of basic fourier transform pairs, systems characterized by Linear constant coefficient differential equations.

Text1: 3.3, 3.5, 4.1 to 4.7. **10 Hrs**

UNIT – IV

Discretization of CT signals and Fourier representation of Discrete-time (DT) signals

Sampling of CT Signals: Representation Of continuous-Time signals by its samples: The sampling theorem, Reconstruction of continuous time signals from samples. The effect of under sampling: Aliasing,

Fourier representation for DT non periodic signals : Representation of Aperiodic signals: The discrete- Time fourierTranform, the Fourier Transform for periodic signals, Properties of the Discrete- Time Fourier transforms, Tables of Fourier Transform Properties and Basic Forier Transform Pairs.

Text1:7.1, 7.2, 7.3, 3.6, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 **11 Hrs**

UNIT – V

Z–Transforms: Introduction, The Z – transform, The region of convergence for the Z-transform, The inverse Z-transform, Geometric evaluaution of the fourier transform from the pole-zero plot, properties of Z – transforms, some common Z-transform pairs, Analysis and characterization of LTI systems using Z-transforms, system function algebra and block diagram representations, The Unilateral Z transform.

Text1: 10.0 to 10.9 **11 Hrs**

Self-learning component:

1. Example 1.1 to 1.5 of text 1. Check the periodicity, energy and power a signal.
2. Example 2.1, 2.3 to 2.8 of text 1 Check the causality, time invariant and linearity of the system
3. Example 3.2 to 3.6 of text 1. Find the convolution of two discrete time signals and Fourier transform of the signal.
4. Example 5.1 to 5.3 and 7.1 to 7.3 of text 1.
5. Find Z transform of the unit impulse, unit step, cosine signals and find the z transform using differentiation property

Note:

- Use software (Scilab/ Matlab/ octave) and simulate self -learning component Study of simulation tools.
- https://scilab.in/textbook_run/842/55/5

TEXT BOOK:

"Signals and Systems", V.Oppenheim, Alan Willsky and A.HamidNawab, Pearson education asia/PHI, 2nd edition, 2006. ISBN: 9789332550230, 9332550239

REFERENCE BOOKS:

1. **"Signals and Systems",** Simon Haykin and Barry Van Veen, 2nd Edition John Wiley & Sons, 2nd edition 2008. ISBN:9788126512652, 8126512652.

2. **"Signals and systems",** H.P.Hsu, R.Ranjan, Schaum's outlines, TMH, 2006. ISBN:9780070669185, 007066918X
3. **"Signals and systems",** A NagoorKani, McGraw Hill 2010 . ISBN: 9780070151390, 0070151393.
4. **"Fundamentals of signals and systems",** Michael J Roberts, Govind Sharma, McGraw Hill 2010. ISBN: 0070702217, 9780070702219.

D. Course Outcomes

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	**Apply** knowledge of basic mathematics to classify different signals and systems	L2 (PO1)
CO2	**Analyze** signals and systems to determine their properties.	L4 (PO2)
CO3	**Analyze** LTI/LSI systems in time domain and frequency domain to determine system output and properties.	L4(PO2)
CO4	**Analyze** CT and DT system and implement using different structures.	L3 (PO2,PO3)
CO5	Commenting on existing demo, group activity based learning new tools and **solving** problems using tools	L2(PO5,PO9)

E. Course Articulation Matrix (CAM)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
#1	**3**												**3**	
#2		**2**												**2**
#3		**3**												**3**
#4		**2**	**1**											**2**
#5					**1**				**1**					

A. Course Plan			
Course Title: **Digital Circuit Design Laboratory**			
Course Code: **P17ECL37**	Semester: **III**	L – T – P : 0 - 0 – 3	Credits:1.5
Contact Period - Lab: 36 Hrs.; Exam: 3 Hrs.		Weightage: CIE: 50 %;	SEE: 50%

B. Course Learning Objectives (CLOs):

This Course aims to;

1. Help the designer to simplify and realize the Boolean expressions.
2. Provide the knowledge to realize the half, full adder, half and full subtractor, parallel adder and parallel subtractor.
3. Provide the idea to design the Binary to Gray Code conversion circuit and 2–bit comparator and priority encoder.
4. Construct and realize combinational circuits using MUX and DEMUX.
5. Provide the understanding of JK, T and D flip flops to realize the different types of counters.
6. Understand the working of shift–register to design Ring Counter and Johnson Counter.
7. Understand the application of digital design: Digital Elevator Circuit.

C. Course Content

EXPERIMENTS:

1. Simplification, realization of Boolean expressions using logic gates and Universal gates.
2. Realization of half and full adders, half and full subtractor using logic gates.
3. a. Realization of parallel adder and parallel subtractor using 7483 chip
   b. Demonstration of BCD to Excess–3 code conversion and vice versa.
4. Realization of AND, OR, NOT, NAND, NOR, XOR and XNOR logic gates using MUX.
5. Application of the IC's – MUX–74153 for half and full adders, DEMUX – 74139 for 3 – bit binary to gray and BCD to Excess–3 code converters.
6. Realization of 2 – bit comparator using gates and basic operation study of Priority encoder using 74147.
7. Truth table verification of Flip–Flops: (i) T type (ii) D type and iii) J–K Master slave.
8. Realization of 3 bit binary, decade counters using 7476, 7490, 74192/74193 chips respectively and display the count on seven segment display.
9. Design MOD – N counters and display the count on seven segment display
10. Realization of Shift left, Shift right, SIPO, SISO, PISO, PIPO register operations using 7495.
11. Design the Ring counters and Johnson counter.
12. Demonstration of Digital Elevator Circuit Using 7447, 74190, 7485 and basic gates.

Open ended Experiments:

1. Design and implement a circuit to synthesize clock signal of given frequency.

or

2. Design and implement a circuit to count event and latch it.

or

3. Design and implement a circuit to control traffic signal (Simple function).

D. Course Outcomes

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	Analyze and optimize the logic circuit for given Boolean expressions	PO2
CO2	Design and Implement Combinational Logic circuits	PO3
CO3	Design and Implement Sequential Logic circuits	PO3
CO4	Develop a logic circuit for the given problem or situation	PO5

E. Course Articulation Matrix (CAM)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
#1		**3**												**3**
#2			**3**											
#3			**3**											
#4					**1**									
#5														
#6														

A. Course Plan

Course Title: **Analog Electronics Laboratory**			
Course Code: **P17ECL38**	Semester: **III**	L – T – P : 0– 0 - 3	Credits:1.5
Contact Period: Lecture:36Hrs.; Exam:3 Hrs.		Weightage: CIE: 50%; SEE: 100%	

B. Course Learning Objectives (CLOs)

This course aims to

1. Provide the basic knowledge of how to use CRO, signal generator, bread board, power supply, ammeter, voltmeter and how to rig-up the circuits.
2. Analyze the characteristics of MOSFET, Op-amp.
3. Design Inverting and Non-inverting amplifiers, Summing, Subtracting and Schmitt trigger circuit using Op-Amp.
4. Demonstrate the working of Integrator, Differentiating circuit, precision half wave and full wave rectifier using 741 IC
5. Design the different types of oscillators using MOSFET and Op-amp.
6. Understanding the working DAC using Op-Amp and Voltage regulator using LM 217 IC regulator.

C. Course Content

1. MOSFET drain and transfer characteristics
2. RC coupled single stage MOSFET amplifier and determination of the gain- frequency response curve, input and output impedances.

3. Op-amp RC phase shift oscillator.
4. Hartley and Colpitts oscillator using MOSFET.
5. Determining the Characteristic parameters of Op-Amp 741 IC
6. Design of Inverting and Non-inverting amplifier using 741 IC
7. Op-amp as summer, subtractor and voltage follower
8. Op-amp as Integrator and Differentiator circuit
9. Precision half wave and full wave rectifier using 741 IC.
10. Design of Schmitt trigger and zero crossing detection using 741 IC
11. R-2R DAC using Op-amp.
12. Voltage regulator using LM 217 IC regulator.

Open ended experiment
(experiments are indicative, teacher can choose to give different one.

1. Conduct an experiment to find Y= Differentiate (P+Q-R) where P, Q and R are sinusoidal signals
2. Conduct an experiment to sum two sinusoidal signals of peak amplitude 4v and clip the output level to 5v.

D. Course Outcome

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	**Analyze** the MOSFET characteristics, working of amplifier and oscillator with MOSFET and Op-amp, and to find characteristics of Op-Amp.	PO2, [L3]
CO2	**Design** the inverting and non-inverting amplifier for a given gain, Schmitt trigger circuit for a given LTP and UTP, and voltage regulator using LM217 regulator.	PO3, [L4]
CO3	**Ability** to conduct experiments using op-amps and other electronic components on summer, subtractor, voltage follower, integrator, differentiator, rectifiers and DAC circuits.	PO2, [L4]
CO4	**Ability** to work effectively in a team to analyze the given design and conduct experiment.	PO2, PO9 [L4]

E. Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
#1		**2**												**2**
#2			**3**											
#3		**3**												**3**
#4		**2**							**2**					**2**

Course Title: Aptitude and Reasoning Development - BEGINNER. (ARDB)			
Course Code : P17HU39	Semester : III	L-T-P-H : 0-0–2-2	Credits: NA
Contact Period: Lecture: 32 Hr, Exam: 3 Hr		Weightage :CIE:100% - [P/NP]	

Prerequisites: Basics of mathematics.

Course Learning Objectives (CLOs)

This course aims to

1. Solve the mathematical calculations easily and quickly using the methods of vedic mathematics.
2. Illustrate different examples to learn about percentages effectively.
3. Compare the different types of series.
4. Explain the logic behind solving problems under series such as A.P., G.P., H.P.
5. Explain divisibility rules, properties of different types of numbers.
6. Explain methods to find the number of factors and sum of factors.
7. Analyze the concept of power cycle, and find last digit and last two digits.
8. Solve problems involving simple equations and inequalities.
9. Explain Componendo, Dividendo, Invertendo, Alternendo and other terms related to ratio and proportion.
10. Explain the concepts behind the logical reasoning modules such as arrangement, blood relations and directions

Relevance of the course:

3rd Semester is considered as the right time to build a base to a student's analytical and logical ability. This course connects the basics of maths learnt in school into the present problem solving techniques. It creates an awareness towards the importance and significance of an individual's logical abilities.

Course Content

Unit – I

Sharpen your axe!!

Vedic mathematics:

Viniculum and de- viniculum, subtractions using viniculum .Nikhilum multiplication: For numbers close to base values, multiplication of any two digit numbers or three digits number using criss cross method. Finding the square, square root, cubes , cube root of two digit and three digit numbers quickly. Approximation in multiplication and division. Checking the answer using digital sum method

SSC- Get hands on multiplication tables, increasing the speed in basic arithmetic operations. Classification of numbers.

Percentage calculations and ratio comparison:

Percentage calculations: Percentage rule for calculating , percentage values through additions, percentage– fraction table, approximation in calculating percentages. Application based problems

Ratio comparison: calculations method for ratio compressions: 1. the cross multiplication method, 2. percentage value compression method 3. numerator and denominator percentage change method. Method for calculating the value of percentage change in the ratio. Application based problems.

SSC - Thorough with fractions and decimal values. Applications of tabulated fractions. Product of means and extremes. **8 Hrs**

Unit – II

Analytical Reasoning 1: series

Number series: Standard patterns of number series, pure series: perfect square, square cube, prime, combination of this series. Difference series, ratio series, mixed series, geometric series, two-tier arithmetic series, three-tier arithmetic series, change in the order for difference series, change in the

order for ratio series, sample company questions.
Letter series: Alphabet and Alphanumeric series, finding the missing term based on logic learnt in number series module, continuous pattern series, correspondence series. sample company questions.
Picture series : image analysis, addition deletion rotation or modification of lines or shapes. Understanding the symmetry of the image. Mirror image analysis. sample company questions.

SSC - Basic knowledge of letter positions, Different number series for example – even, odd, prime, composite etc **6 Hrs**

Unit – III

Number system:
Introduction, **Integers:** Remainder zero concept, Odd and Even Integers, Negative and positive integers, power number a^x, properties of a perfect square number. **Prime number:** General method to identify the prime number, properties of prime numbers. Euler's number. **Factorial number:** Wilson's theorem, important results on factorial. **Divisor:** number of divisors, sum of divisors, number expressed as the product of two factors.
Divisibility rules: divisibility of a whole number by a whole number, divisibility of an expression by an expression. **Modulus concept:** divisibility rules in modulus, rules of operations in modulus. **Finding one remainder:** One divisor, remainder of $(a^n - b^n)$, remainder for more than one divisor.
Unit digit: Concept of power cycle, finding last two digits**.** Number of trailing zeroes.
SSC -Basic arithmetic operations, knowledge about quotient and remainders, multiples and factors.
6 Hrs

Unit – IV

Simple equations, Ratio Proportions and Variations:
Simple equations: Linear equations-Linear equations in one variable, linear equation in two variables, Different methods of solving linear equations in two variables– Method of elimination, Method of substitution, Method of cross multiplication. Format of equations that can be converted to linear equations, Linear equations of three variables, Inequalities and its properties. Advanced problems on Simple equations. Age problems.
Ratio Proportions and Variations: Understanding the meaning and difference between ratio, proportion and variation. Properties of ratio, Comparison of more than two quantities, Proportion, Properties of proportion - Componendo, Dividendo, Invertendo, Alternendo. Continued proportion, Mean proportion. Variation - Direct variation, Indirect variation, Joint variation, Short cut methods to solve problems on variation.
SSC -Knowledge about factors, types of factors. Splitting the middle term rule, formula rule.
6 Hrs

Unit – V

Building the fundamentals of logical reasoning:
Arrangement:
Approach to tackle questions, Different types of arrangement– Linear arrangement, Circular arrangement. Selection, Double line map. Possible ways of arrangement– Words or numbers, left side only, right side only, left right alternate, increasing or decreasing order, interchange vs push, Strategy for solutions– some tips for quick answers, general strategy.
Directions:
Basics. Pythagorean theorem, Pythagorean triplets, Solving problems for practice.
Blood relations:
Some typical relations that we come across, family tree, Structuring the given problem step by step. Suggested methods– Backtracking, drawing family tree. Problems on blood relations and professions.
SSC -Basic knowledge of directions, Pythagoras theorem. Logical reasoning skills, Relations, Family

tree. **6 hrs**

Reference Books:

1. The Trachtenberg speed system of basic mathematics, published by Rupa publications.
2. CAT Mathematics by AbhijithGuha. published by PHI learning private limited.
3. Quantitative aptitude by Dr. R. S Agarwal, published by S.Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal , published by S. Chand private limited.
5. Quantitative aptitude for CAT by Arun Sharma, published by McGraw Hill publication.
6. Analytical reasoning by M.K Pandey BSC PUBLISHING.CO.PVT.LTD

Course Outcomes

After learning all the units of the course, the student is able to:

1. Solve mathematical calculations in less duration compared to the conventional method. L2
2. Give examples for AP, GP and HP and differentiate between them. L1
3. Apply divisibility rules , power cycle method and evaluate the significance of the number system module. L2
4. Point out the errors in the problems concerning inequalities and solve simple equations and problems based on ratio, proportion and variation. L5
5. Solve the problems based on blood relations, directions and arrangement. L4

Course Articulation Matrix

Course Outcomes		Program Outcomes												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	Solve mathematical calculations in less duration compared to the conventional method.	_	3	1	2	3	_	_	_	_	_	_	_	_	_
CO2	Give examples for AP, GP and HP and differentiate between them.	2	1	_	_	_	_	_	_	1	_	_	_	_	_
CO3	Apply divisibility rules, power cycle method and evaluate the significance of the number system module.	_	3	3	_	_	_	_	_	_	_	_	_	_	_
CO4	Point out the errors in the problems concerning inequalities and solve simple equations and problems based on ratio, proportion and variation.	_	_	_	_	_	_	_	2	_	2	2	_	_	_
CO5	Solve the problems based on blood relations	_	3	_	_	_	_	_	_	_	_	1	_	_	_

Course Title : Additional Maths-I			
Course Code : P17MADIP31	Semester : 3	L:T:P:H : 4:0:0:4	Credits: NA
Contact Period: Lecture: 52 Hr, Exam: 3 Hr	Weightage: CIE:50%, SEE:50%		

((Mandatory Learning Course: **Common to All Branches)**

(A Bridge course for Diploma qualified students of III Sem. B. E.)

Course Content

UNIT -I

Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof). Roots of complex number - Simple problems.

Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors(Dot and Cross products). Scalar and vector triple products-simple problems.

12Hrs

UNIT -II

Differential Calculus: Review of successive differentiation. Formulae for n^{th} derivatives of standard functions- Liebnitz's theorem(without proof). Polar curves –angle between the radius vector and the tangent pedal equation- Problems. Maclaurin's series expansions- Illustrative examples. Partial Differentiation : Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. Application to Jacobians, errors & approximations. **10 Hrs**

UNIT -III

Integral Calculus: Statement of reduction formulae for $sin^n x$, $cos^n x$, *and* $sin^m x cos^m x$ and evaluation of these with standard limits-Examples. Differentiation under integral sign(Integrals with constants limits)-Simple problems. Applications of integration to area, length of a given curve, volume and surface area of solids of revolution. **10 Hrs**

UNIT-IV

Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). Solenoidal and irrotational vector fields-Problems.

10 Hrs

UNIT-V

Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: homogeneous**,** exact, linear differential equations of order one and equations reducible to above types. Applications of first order and first degree ODE's - Orthogonal trajectories of cartesian and polar curves. Newton's law of cooling, R-L circuits-Simple illustrative examples from engineering field. **10 Hrs**

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 42^{nd} Ed. 2012.

References:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 6^{th} Ed., 2007.
2. N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7^{th} Ed., 2007.

4th SEMESTER

Course Title: Engineering Mathematics-IV			
Course Code: P17MAAC41	Semester: IV	L – T – P – H : 4– 1 – 0 – 5	Credits:4
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		Weightage: CIE: 50%; SEE: 50%	

Prerequisites: The student should have acquired the knowledge of Engineering Mathematics-I, II and III of I, II and III semester B.E.

Course Learning Objectives (CLOs):

This Course aims to;

1. Understand the basics of functions of complex variables, analytic functions, conformal and bilinear transformations, complex integration, line/surface/volume integrals and residue theorems with their scientific/engineering importance
2. Solve algebraic, transcendental and ordinary differential equations arising in various engineering flow and design data problems, using numerical techniques along with physical interpretation of the solutions associated with initial/boundary conditions.
3. Apply the basic tools of statistics to understand curve fitting, moments, skewness, kurtosis, correlation and regression, for frequency distributions; explore the idea of probability, probability distributions, required in the analysis of engineering experiments
4. Apply the basic concepts of probability distributions to understand concept of joint probability and to find expectation covariance, correlation coefficient etc. and to understand probability vector, stochastic matrix etc.

   Understand iterative methods in linear algebra such as Gauss-Jacobi, Gauss -Seidel, Relaxation and Power method and their practical utility in engineering fields.
5. Explain functional and extremal of functional Euler's equation and applications of calculus of variations to the standard variational problems and basic concepts of reliability theory including failure laws required in the analysis of engineering experiments occurring in engineering fields.

   Obtain series solution of essential ODE's such as Bessel's and Legendre's differential equations and understand their scientific/engineering utility

Relevance of the Course:

Engineering Mathematics-IV deals with Complex analysis. Here we understand the basics of complex variable, analyticity and potential fields through complex potential and conformal transformations interpret the solution in fluid flow and electromagnetic problems.

The process of complex integration and series representation of functions of complex variables in field theory and other Engineering applications.

Solving algebraic, transcendental and ordinary differential equations arising in various engineering flow and design data problems.

In Statistics interpretation and analyzing the data, fitting of curves of best fit for experimental data arising in engineering calculations and analyze the same by expressing in the form of regression lines.

Probability distributions and use them in analyzing and solving engineering problems associated with probability models

Variational problems used in structural engineering, aerospace, ground water flows and environmental fluid dynamics, etc

Understand series solution of ODE's and special functions in engineering fields.

Course Content

UNIT-I

Complex Analysis: Introduction to functions of complex variables. Definitions- limit, continuity and differentiability. Analytic functions. Cauchy–Riemann equations in Cartesian and polar forms problems on properties of analytic functions (No proof). Construction of analytic function: Milne-Thomson method. Conformal transformation–Definitions. Discussion of transformations: $w=z^2$, $w=e^z$, $w = z + 1/z \ (z \neq 0)$ Bilinear transformations.

Complex integration: complex line integrals. Cauchy theorem, Cauchy integral formula. Taylor's and Laurent's series (Statements only). Singularities, poles and residues. Cauchy residue theorem (statement only). Simple illustrative examples.

SSC: Derivation of Cauchy- Riemann equation in Cartesian and polar form. Derivation of Cauchy theorem, Cauchy integral formula and Cauchy's residue theorem. **11 Hrs**

UNIT-II

Numerical Methods-II: Solution of algebraic and transcendental equations: Bisection method, Regula-False & Newton–Raphson method. Fixed point iteration method: Aitken's Δ^2 - process - Illustrative examples only.

Numerical solution of ordinary differential equations (ODE's): Numerical solutions of ODE's of first order first degree – Introduction. Taylor's series method. Modified Euler's method, Runge - Kutta method of IV order, Milne's and Adams predictor & corrector methods (All formulae without proof).

Self-Study Component: Solution of second order ordinary differential equations using Runge-Kutta methods. Solution of first order simultaneous differential equations. **10 Hrs**

UNIT-III

Statistics: Brief review of measures of central tendency and dispersion. Moments, skewness and kurtosis. Curve fitting-least square method: $y = a + bx$; $y= ax^b$, $y = ab^x$ and $y= ax^2 +bx+c$. Prof. Karl Pearson's coefficient of correlation and lines of regression.

Probability Theory: Brief review of elementary probability theory. Random variables (discrete and continuous)-Introduction to probability distributions- probability mass/density functions and cumulative probability density functions – Illustrative examples. Discrete probability distributions- Binomial and Poisson's distributions; Continuous probability distributions -

exponential and normal distributions. (No derivation of mean and variance). Illustrative examples from engineering and industrial fields.

SSC: Basic definitions of probability and problems up to Bayes' theorem. To fit curves of the type : $y = ae^{bx}$, Derivation of Mean and SD of Binomial &Poisson distribution**.** **11 Hrs**

UNIT-IV

Joint probability distributions and Markov chains:

Concept of joint probability. Joint probability distributions of discrete random variables. Expectation, covariance, correlation coefficient – simple examples. Probability vectors, stochastic matrices. Fixed point and regular stochastic matrices.

Linear Algebra-II: Numerical methods for system of linear equations- Gauss-Jacobi and Gauss-Seidel iterative methods. Relaxation method**.** Determination of largest eigen value and corresponding eigen vector by power method.

SSC: Ramanujan's Method to find the smallest root of a polynomial**.** **10 Hrs**

UNIT-V

Calculus of Variations: Variation of a function and a functional, extremal of a functional. Variational problems – Euler's equation. Applications to standard variational problems including geodesics, minimal surface of revolution, hanging chain and brachistochrone problems.

Series solutions of ODE's and special functions: Power series solution of a second order ODE, Series solution-Frobenius method. Series solution leading to $J_n(x)$- Bessel's function of first kind. Expansions for $J_{1/2}(x) and\ J_{-1/2}(x)$. -simple related examples. Series solutions of Legendre's differential equation leading to $P_n(x)$-Legendre's polynomials. Rodrigue's formula (No Proof) - simple illustrative examples.

SSC: Basics of Series solutions of ODE's; analytic, singular point and basic recurrence relations **10 Hrs**

Text Books:

1. Higher Engineering Mathematics: B.S. Grewal, Khanna Publishers, New Delhi, 42nd Ed. 2012.
2. Advanced Engineering Mathematics: - E. Kreyszig, John Wiley & Sons, 10th Ed., 2011

References:

1. Probability: - Seymour Lipschutz, Schaum's outline series, McGraw-Hill publications, **2nd Edition, 2002**.
2. Introductory Methods of Numerical Analysis: - S.S.Sastry, PHI, 3rd Ed.2000.
3. Advanced Modern Engineering Mathematics: - Glyn James, Pearson Education Ltd., 3rd Edition, 2011.
4. Higher Engineering Mathematics: - B.V. RAMANA, McGraw Hill Education, 2007

Note: - Each unit contains ***two*** full questions of ***20 marks*** each. Students are required to Answer ***five*** full questions choosing at least ***one*** question from each unit.

Course Outcomes

After learning all the units of the course, the student is able to;

1. Explain the concept of analyticity and potential fields through complex functional/potential, conformal transformations and interpret the solution in fluid flow and electromagnetic problems and describe the process of complex integration and learn series representation of a function of complex variables, residues and poles.
2. Apply the familiarity of numerical methods for solving algebraic and transcendental equations and demonstrate single-step and multi-step numerical methods for solving ordinary differential equations and interpret the solution in engineering applications.
3. Apply the knowledge of statistics in interpretation the data, fitting of a linear and non-linear curves of best fit for experimental data arising in engineering calculations and analyze the same by expressing in the form of regression lines. And, Illustrate the concept of random variables (discrete/continuous) and related probability distributions and use them in analyzing and solving engineering problems associated with probability models
4. Define the concept of joint probability of two random variables and apply the knowledge of joint probability distribution in interpreting data through statistical measure. And, analyze the notion of higher transition probabilities, the Markov chain and queuing models arising in engineering problems for feasible random events.

Understand the procedure of numerically solving large systems of linear algebraic equations and obtaining eigen value and eigen vector corresponding to a large eigen vector, with the aid of standard methods of numerical linear algebra.

5. Explain functional and extremal of functional Euler's equation and applications of calculus of variations to the standard variational problems and basic concepts of reliability theory including failure laws required in the analysis of engineering experiments occurring in engineering fields.

Obtain series solution of essential ODE's such as Bessel's and Legendre's differential equations and understand their scientific/engineering utility

Course Articulation Matrix

Mapping of Course Outcomes (CO) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Title : Engineering Mathematics –IV												
CO's	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO-1	**2**	**2**	-	-	-	-	-	-	-	-	-	-
CO-2	**3**	**3**	-	-	-	-	-	-	-	-	-	-
CO-3	**3**	**3**	-	-	-	-	-	-	-	-	-	-
CO-4	**2**	**2**	-	-	-	-	-	-	-	-	-	-
CO-5	**3**	**3**	-	-	-	-	-	-	-	-	-	-

A. Course Plan -Core			
Course Title : **Analog and Digital Communication**			
Course Code**: P17EC42**	Semester : **VI**	L-T-P: 4 – 0 - 0	Credits:4
Contact Period : Lecture :52 Hr, Exam: 3Hr		Weight age: CIE:50% SEE:50%	

B. Course Learning Objectives (CLOs)

This course aims to

1. Analyze the elements of communication system, provide basic knowledge of Modulation, generation, detection and application of Amplitude and Angle modulation of signal in both time domain and frequency domain.
2. Explain the aspects of sampling of signals in digital communication, the model of digital communication system and outline the use of Correlation.
3. Describe random variables, random process, autocorrelation and cross-correlation function, Gaussian process and its properties.
4. Explain quantization process, quantizes and commanding of signals in PCM system.
5. Describe the principle of DM, ADM, DPCM systems,
6. Describe and contrast various aspects of different digital coherent and non coherent modulation schemes such as ASK, FSK, PSK, QPSK, DPSK and MSK.
7. Design digital modulation system for specific applications.
8. Analyze different coding schemes adopted in PAM signaling and explain the causes for the occurrence of ISI and advantages of pulse shaping & correlation coding.

C. Course Content

UNIT-I

Amplitude Modulation: Introduction to communication, Elements of communication system, Amplitude Modulation: time domain and frequency domain description, single tone modulation, efficiency of modulation, Generation of AM wave: Switching Modulator. Detection of AM waves: envelope detector, DSB-SC Modulation: Time domain and frequency domain description, SSB-SC Modulation: Time-Domain and frequency domain, FDM.

Angle Modulation: Time domain representation of PM and FM waves, Frequency modulation: Frequency deviation and modulation index, Narrow band frequency modulation, Wideband Frequency Modulation, Generation of FM wave: Direct Methods, Demodulation of FM signals: frequency discrimination method.

Text1: 1.1, 3.1-3.3, 3.6, 3.9, 4.1-4.8 **11 Hrs**

UNIT-II

Random Signals: Random variables, Random Process, Mean, correlation and covariance function, properties of autocorrelation function, cross-correlation functions, Gaussian Process, properties of Gaussian process.

Introduction to Digital Communication: Sources and signals, Block diagram of digital communication, Channels for Digital communication, Comparison of analog and digital communications, Model of digital communication system, Gram-Schmidt Orthogonalization, Correlation Receiver.

Text1:8.1, 8.2, 8.4, 8.6,8.7, 8.9

Text 2:1.1-1.3, 3.1, 3.2, 3.7 **10 Hrs**

UNIT-III

Sampling: Sampling theorem, Quadrature sampling of band-pass signals, reconstruction of message process from its samples, signal distortion in sampling, practical aspects of sampling and signal recovery, Pulse Amplitude Modulation, Time Division Multiplexing

Base–Band Shaping for Data Transmission: Discrete PAM signals, Power spectra of discrete PAM signals. ISI, Eye Pattern, Baseband M–ary PAM systems, Adaptive Equalization for data transmission.

Text1: 4.1-4.7, 6.1-6.3, 6.6-6.8. **10 Hr**

UNIT-IV

Waveform Coding Techniques: Pulse Code Modulation, Channel noise and error probability, Differential Pulse Code Modulation, Delta Modulation, Quantization noise in DM, Adaptive Delta Modulation.

Text 1: 5.1-5.6 **10 Hrs**

UNIT-V

Digital Modulation Techniques-I: Digital Modulation Formats, Coherent Binary Modulation techniques, Coherent binary PSK, Coherent binary FSK, Coherent Quadrature modulation techniques, QPSK,MSK.

Digital Modulation Techniques-II Non–coherent binary modulation techniques, comparison of Binary and Quaternary Modulation techniques.

Text 1: 7.1 to 7.5 **11 Hrs**

TEXT BOOK:

1. **"An Introduction to Analog and Digital Communications",**Simon Haykin, John Wiley and Sons, Inc. 2013, ISBN:9788126536535.
2. **"Digital Communication",** SimonHaykin, JohnWiley,2008.ISBN:9788126508242.

REFERENCE BOOKS:

1. **"Digital Communication",** P.Ramakrishna Rao.TATA McGraw Hill ,2011, ISBN:9780070707764.
2. **"Digital and Analog Communication System**s",SamShanmugam JohnWiley, 1996.ISBN:9788126509140.
3. **"Simon Haykins , "Communication Systems",** 5th Edition, John Willey and Sons..
4. **"Digital Communications",** John G. Proakis, MasoudSalehi, Mc Graw Hill, 5th edition, 2008.ISBN-10: 9339204794

Self- Learning Components

Students can make use of:

i. Text books, journals, articles for case studies.
ii. Simulation tools MATLAB, SCILAB, MULTISIM, PROTEUS, LABVIEW, COMMSIM or any other similar simulation tools for simulating the concepts. (Student must study on own and follow instructions of faculty for assessment).

UNIT	SLC (Self- learning components)
UNIT-I	1. Simulate analog modulation techniques and investigate/demonstrate the impact of modulation index on percentage of modulation by analyzing the spectrum generated using simulation tools. 2. Study different types of noise in communication systems, Noise in continuous-wave modulation systems and Pre –emphasis and De – emphasis in FM System

UNIT-II	3. Verify sampling theorem by simulating the impact of under-sampling, sampling and over-sampling conditions. 4. Using the mathematical model of digital communication study the detection and maximum likelihood estimation of signals in noise. Analyze the significance of matched filters in optimum receiver implementation.
UNIT-III	5. Evaluate the performance of uniform and non-uniform Quantization using simulated model. 6. Generate different types of discrete PAM signals for a given N bit input signal and eye diagram for binary and quaternary system using simulator. 7. Study the importance of Nyquist's criterion for distortion less base–band binary transmission.
UNIT-IV	8. Using a Simulated model Generate Pulse Code Modulated waveform and demonstrate the working principle of DPCM,DM.
UNIT-V	9. Implement generation and detection of a signal for digital modulation schemes (ASK,FSK,PSK,QPSK) signal using simulation tool/model. 10. Investigate the effect of varying message frequency, carrier frequency and modulation frequency on the power spectrum of BASK, BPSK, QPSK, BFSK by plotting waveforms using a simulation tools(do in teams).

D. Course Outcome

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	**Apply** the basic knowledge of mathematics for Formulation and analysis of Random signals, Analog and Digital communication system.	PO1, [L3]
CO2	Ability to **Analyze** various aspects of sampling, quantizing, encoding, Analog and Digital signal modulation/transmission and demodulation/reception techniques.	PO2, [L4]
CO3	**Articulate** the methods used for sampling, quantizing and **analyze** noise introduced in data transmission for designing a digital communication systems.	PO2, [L2]
CO4	**Analyze** the error probabilities and SNR of various modulation schemes with the knowledge of random process.	PO2, [L4]
CO5	**Apply** appropriate techniques, resources and modern tools to **examine** and **design** elementary communication system for various modulation schemes and noise specification.	PO2, PO9 [L4]

E. Course Articulation Matrix (CAM)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
#1	**3**					**3**	**2**							**2**
#2		**3**				**2**								
#3		**2**			**2**	**2**								
#4		**2**			**2**									
#5				**2**			**3**							**2**

A. Course Plan - Core			
Course Title: **Digital Design Using Verilog HDL**			
Course Code: **P17EC43**	Semester : **IV**	L-T-P: 4 – 0 - 0	Credits: 4
Contact Period : Lecture :52 Hr, Exam: 3Hr		Weight age: CIE:50% SEE:50%	

B. Course Learning Objectives (CLOs)

This course aims to

1. Explain the working knowledge of a broad variety of verilog based topic for global understating of verilog HDL based design.
2. Describe the practical design perspective of verilog HDL.
3. Explain the logical progression of verilog HDL based topics.
4. Explain the basics and some advanced topics such as PLI and logic synthesis.
5. Explain the small models and run simulation.
6. Discuss the advance concepts such as UDP, timing simulation PLI and logic synthesis.
7. Explain the concepts applicable to the design of FPGA, PAL buses, boards and system, as well as ASIC design.

C. Course Content

UNIT-I

Basic Concepts: Lexical Conventions, Data Types, System Tasks and Compiler Directives.
Modules and Ports: Modules, Ports, Hierarchical Names.
Gate-Level Modeling: Gate Types, Gate Delays.
Dataflow Modeling: Continuous Assignments, Delays, Expressions, Operators, and Operands, Operator Types, Examples.
Text 1: Chapters 3, 4, 5 and 6 **11 Hrs**

UNIT-II

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, Multiway Branching, Loops, Sequential and Parallel Blocks, Generate Blocks. Examples.
Tasks and Functions: Difference between Tasks and Functions, Tasks, Functions.
Text 1: Chapters 7and 8 **10Hrs**

UNIT- III

Useful Modeling Techniques: Procedural Continuous Assignments, Overriding Parameters, Conditional Compilation and Execution, Time Scales, Useful System Tasks.
Timing and Delays: Types of Delay Models, Path Delay Modeling, Timing Checks, Delay Back-Annotation.
Switch Level Modeling: Switching-Modeling Elements, Examples.
Text 1: Chapters 9, 10 and 11 **10 Hrs**

UNIT-IV

User-Defined Primitives: UDP basics. Combinational UDPs, Sequential UDPs, UDP Table Shorthand Symbols, Guidelines for UDP Design.
Programming Language Interface: Uses of PLI, Linking and Invocation of PLI Tasks.Internal Data Representation, PLI Library Routines.
Logic Synthesis with Verilog HDL: What Is Logic Synthesis? Impact of Logic Synthesis, Verilog HDL Synthesis, Synthesis Design Flow.
Text 1: Chapters 12, 13 and 14.1 -14.4 **10 Hrs**

UNIT-V

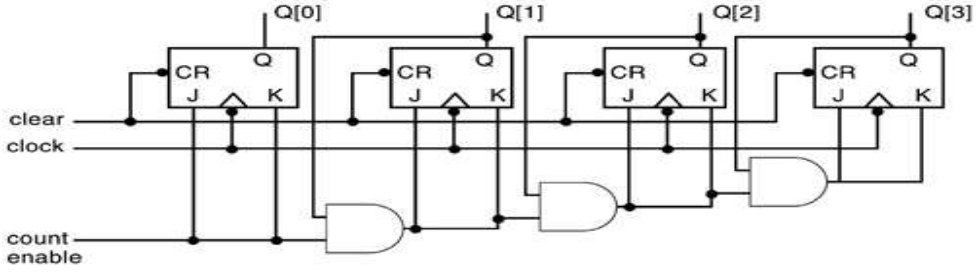
Logic Synthesis with Verilog HDL: Verification of the Gate-Level Netlist, Modeling Tips for Logic Synthesis, Example of Sequential Circuit Synthesis.

Advanced Verification Techniques: Traditional Verification Flow, Assertion Checking, Formal Verification.

Text 1: Chapters 14.5-14.7 and 15 **11 Hrs**

Self Learning Components:

Develop a verilog code and test bench for following question and verify it by using any EDA tool (xilinix/ libero /vivado/ iverilog etc).

Unit-I	1. Study typical design flow for designing VLSI Circuits. 2. Design 2 to 1 mux using bufif0 and bufif1. 3. Design 4 bit mod 13 counter and display all input and output values in command window.
Unit II	1. Design 8 bit ALU Using task or function. 2. Design clock with time period = 80 and duty cycle of 40 % using always & initial statement.
Unit III	1. Design 16 to 1 mux using 4 to 1 mux and display all input and output values in command window. 2. Create a design that uses the full adder example above. Use a conditional compilation (`ifdef). Compile the fulladd4 with defparam statements if the text macro DPARAM is defined by the `define statement; otherwise, compile the fulladd4 with module instance parameter values. 3. Switch Level Verilog Description for XOR gate.
Unit IV	Design the 4-bit synchronous counter shown below (Use the UDP jk_ff). 

Unit V	A 1-bit full subtractor has three inputs x, y, and z (previous borrow) and two outputs D(difference) and B(borrow). The logic equations for D and B are as follows:
	`D = x'y'z + x'yz' + xy'z' + xyz`
	`B = x'y + x'z +yz`
	Write the Verilog RTL description for the full subtractor. Synthesize the full subtractor, using any technology library available to you. Optimize for fastest timing. Apply identical stimulus to the RTL and the gate-level netlist and compare the output

TEXT BOOK:

1. **"Verilog® HDL, A Guide to Digital Design and Synthesis",** Samir Palnitkar Pearson Education, Second Edition, ISBN 978-81-775-918-4

REFERENCE BOOKS:

1. **"Advanced Digital Design With the Verilog HDL",** Michael d ciletti, PHI, ISBN: 9789332584464, 933258446X
2. **"A Verilog HDL Primer",** J. Bhaskar, BS Publications, ISBN: 9788178000145, 8178000148
3. **"Fundamentals of Digital Logic with Verilog Design",** Stephen brown and Zvonko vranesic, TMH, ISBN: 9780073380544, 0073380547

D. Course Outcome

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	To **apply** the knowledge of digital fundamentals to explain basic concepts used in Verilog HDL	PO1, (L2,L3)
CO2	To **write** a Verilog model for combinational and sequential circuits.	PO1, L3
CO3	To **analyze** the given digital circuit and develop Verilog model for given digital circuits.	PO2, L4
CO4	To **design** any combinational and sequential circuits and develop Verilog model for the given inputs.	PO3, L5
CO5	To **verify** the design through synthesis and demonstrate the application using EDA tools.	PO3,4,5,9,10,11,12 (L4,L5)

E. Course Articulation Matrix (CAM)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
#1	**2**												**2**	
#2	**3**												**3**	
#3		**3**												**3**
#4			**3**											
#5			**3**	**2**	**1**				**2**	**1**	**1**	**1**		

A. Course Plan -Core			
Course Title: **Digital Signal Processing**			
Course Code: **P17EC44**	Semester: **IV**	L – T – P : 4 – 0 - 0	Credits: 4
Contact Period - Lecture:52Hrs.;Exam: 3Hrs.	Weightage: CIE: 50% SEE: 50%		

B. Course Learning Objectives (CLOs):

This Course aims to;

1. Provide the knowledge of DFT/ IDFT and its various properties.
2. Explain the different Fast–Fourier–Transform (FFT) algorithms along with its applications.
3. Provide the design procedure of IIR filters and FIR filters using different techniques.
4. Provide the design of IIR filters from analog filters using different methods.
5. Provide implementation scheme of IIR and FIR filters using different methods.
6. Provide exposure to different applications of DSP

C. Course Content

UNIT – I

Discrete Fourier Transforms (DFT): Frequency Domain Sampling and Reconstruction of discrete-time Signals, Discrete Fourier Transforms, DFT as a linear transformation, its relationship with other transforms. Properties of DFT– Periodicity, linearity and Symmetry Properties. Properties of DFT, multiplication of two DFTs–the circular convolution, additional DFT properties, use of DFT in linear filtering, overlap–save and overlap–add method.

Text 1:7.1.1 7.1.2, 7.1.3, 7.1.4, 7.2.1 7.2.2, 7.2.3, 7.3.1, 11 Hrs

UNIT – II

Fast–Fourier–Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms), Goertzel algorithm, and chirp–z transform. Radix–2 FFT algorithm for the computation of DFT and IDFT–decimation in–time and decimation–in – frequency algorithms, applications of FFT Algorithms.

Text 1: 8.1, 8.1.1, 8.1.2, 8.1.3, 8.1.5, 8.1.6, 8.2, 8.3 10 Hrs

UNIT – III

FIR filter design: Characteristics of Practical Frequency Selective filters, FIR filter design: Introduction to FIR filters, design of FIR filters using – Rectangular, Hamming, Bartlet and Kaiser windows, FIR filter design using frequency sampling technique

Text1: 10.1.2,10.2.1, 10.2.2, 10.2.3, 10.4 10 Hrs

UNIT – IV

Design of IIR filters from analog filters (Butterworth and Chebyshev) : Characteristics of commonly used analog filters – Butterworth and Chebyshev filters., analog to analog frequency transformations. impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms, Verification for stability and linearity during mapping

Text1: 10.3.1, 10.3.2, 10.3.3 ,10.3.4, 10.3.5 11 Hrs

UNIT – V

Implementation of Discrete–time systems: Structures for IIR and FIR systems– direct form I and direct form II systems, cascade and parallel realization, Applications of DSP

Text 1: 9.1, 9.2, 9.3

Text 2 : 12.1 to 12.8 **10 Hrs**

TEXT BOOKS:

1. "Digital Signal Processing – Principles Algorithms & Applications", Proakis & Monalakis, PHI / Pearson Education, 4th Edition, New Delhi,2007. ISBN:978-81-317-1000-5

2. "**Digital signal Processing**"–A.Nagoor Kani,Mc Grawhill education,2nd edition,NewDelhi 2012. ISBN-13: 978-0-07-008665-4, ISBN-10: 0-07-008665-6.

REFERENCE BOOKS:

1."Discrete Time Signal Processing", Oppenheim & Schaffer, PHI,2003. ISBN - 10:9332535035, ISBN-13:9789332535039.

2."Digital Signal Processing", S. K. Mitra, Tata Mc–Graw Hill, 3rd Edition, 2007. ISBN: 9780070667563, ISBN-007066756X.

3."Digital Signal Processing", Lee Tan, Elsevier publications, 2007. ISBN-9780124159822, ISBN-9780124158931.

Note: Teacher will introduce Matlab to students in 2 hours using examples given in text 2

Self Learning Components (Using MATLAB or SCILAB or any similar tools):

UNIT-1

1. Write a program to find the 8-point DFT of Discrete-time sequence x[n]={2,1,2,1,2,2,2,2} and sketch magnitude and phase response.
2. Write a MatLab program to prove the properties of DFT(circular-time shift, Circular-frequency shift, linearity, Periodicity, Time reversal, circular convolution, parseval's relation).
3. Write a MatLab program to find the Circular convolution of two sequences and plot the output.
4. Write a MatLab program to find linear/circular convolution using frequency-domain approach and plot the output.
5. Perform Linear convolution of x[n]={1, 2, 3, -1, -2, -3, 4, 5, 6} and h[n]={2, 1, -1} using overlap add method and plot the output.

UNIT-2

1. Write a MatLab program to generate the twiddle factor matrix.
2. Write a MatLab program to perform circular convolution of two discrete sequence $X_1(n)$={1 2 3 5} 7 $X_2(n)$={5 4 2 4} using FFT and plot the output sequence.

3. Write a MatLab Program to calculate 8 point DFT of a sequence x(n)={2,1,3,8,3,4,5,3} and sketch the magnitude and phase spectrum by considering the frequency domain output sequence find IDFT and plot the magnitude and phase spectrum
4. Using Matlabdetermine X(2) for a sequence x(n)={1,0,2,3} using Goertzl algorithm
5. Using radix-2 DIT-FFT compute the DFT of x(n)={1,4,5,6}
6. Using Radix-2 DIF-FFt compute the IDFT of X(K)={6,-2-2j,2,-2+2j}

UNIT-3

1. Design an digital FIR High pass filter with the following specification$W_p=0.2\pi$, $W_s=0.3\pi$, $R_p=0.25$dB, $A_s=50$dB. Choose an appropriate window.
2. Write a MatLab program to determine impulse response of FIR Band pass filter to pass frequencies in the range 0.35π to 0.48π radians/sample by taking 5 samples of rectangular window sequence.
    a. Hamming window
    b. Hanning window
    c. Rectangular window
    d. Triangular window
    e. Blackman window
    f. Kaiser window and plot the frequency response.
    g. Kalman Filter.
3. Let h(n)={-4, 1, -1, -2, 5, 6, 5,- 2, -1, 1,- 4} using MatLab, determine the amplitude response $H_r(w)$ and the location of zeros of H(Z).
4. Design butterworth low pass filter $f_c=5000$Hz.
5. Using MatLab program realize ChebyshevanalogBandstop filter $f_{c1}=300$Hz & $f_{c2}= 800$Hz
6. Using MatLab find normalized transfer function of an analog low pass filter of third order with cut-off frequency of 10Hz.

UNIT-4

1. Write a matlab program to find the order of butterworthfilter for given specifications $A_p=0.6, A_s=0.1, W_p=0.35\pi, W_s=0.7\pi$
2. Write a matlab program to find the order of Chebyshev-I filter for given specifications $A_p=0.6, A_s=0.1, W_p=0.35\pi, W_s=0.7\pi$
3. Write a matlab program to design an IIR Filter for the following specification using bilinear transformation $A_p=0.9, A_s=0.2, \Omega_p=1$ radians/second, $\Omega_s=2.414$ radians/second.
4. Transform the analog filter $H(S)=\frac{S+3}{(S+1)(S+2)}$ to a digital filter using Matched Z-Transform(T=0.5sec).
5. Write a matlab program to design a second order notch filter with the following characteristics
    i. notch frequencies=400-600Hz
    ii. Sampling frequency= 2.4KHz
    iii. Ripples in passband and monotonic decay in the notch using Bilinear transformation

UNIT-5

1. Find the impulse response of a system given by y(n)=1.5y(n-1)+2y(n-2)+2x(n)+3x(n-2) using MatLab.
2. A filter is described by 16y(n)+12y(n-1)+2y(n-2)-4y(n-3)-y(n-4)=x(n)-3x(n-1)+11x(n-2)-27x(n-3)+18x(x-4). Determine the cascade form structure using MatLab.
3. Afilter is described byy(n)+(3/8)y(n-1)+(3)y(n-2)-4y(n-3)+x(n)+3x(n-1)+2x(n-2)= 0.Determine
    a. Parallel form.
    b. Cascade form.
    c. Direct forms.
4. Write a MatLab function which converts the given co-efficients$b_n$of the direct form to lattice filter co-efficients.
5. An FIR filter is defined as y(n)= 2x(n)+(13/12)x(n-1)+(5/4)x(n-2)+(2/3)x(n-3). Determine its lattice structure.
6. Determine impulse response of FIR filter with lattice parameter K_0=2, K_1=0.6, K_2=0.3, K_3=0.5, K_4=0.9 using MatLab.

D. Course Outcome

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	**Apply** mathematical knowledge to understand DFT, FFT and Filters	PO1, L2
CO2	**Analyze** discrete systems using DFT, FFT and filtering formulation	PO2,L3
CO3	**Design** the FIR & IIR filters for given specification	PO3,L5
CO4	**Implement** the discrete–time systems using various approaches	PO3,L5
CO5	**Understand** role of DSP in various applications	PO1,L4

E. Course Articulation Matrix (CAM)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
#1	**3**												**3**	
#2		**3**												**3**
#3			**3**											**3**
#4			**3**											**3**
#5	**2**												**2**	

A. Course Plan - Core			
Course Title: **Microcontroller**			
Course Code: **P17EC45**	Semester: **IV**	L – T – P : 4 – 0 - 0	Credits: 4
Contact Period - Lecture: 52 Hrs.; Exam:3 Hrs.	Weightage: CIE: 50%; SEE: 100%		

B. Course Learning Objective(CLO's)

This course aims to:

1. Provide the basic knowledge of Embedded systems.
2. Understanding of functionality based on block level approach.
3. Outline the architecture of MSP430.
4. Make use of the instruction sets for writing programs.
5. Discuss the working and applications of interrupts.
6. Utilize the Low-Power Modes for the Operation of MSP430.
7. Summarize the operation of different timers.
8. Describe the on board analog functionalities.

C.Course Content

UNIT – I

Introduction to Microcontrollers: Definition of Embedded Systems, Approaches to Embedded Systems, Small Microcontrollers, Anatomy of a Typical Small Microcontroller, Memory, Software.

MSP430: The Outside View—Pin-Out, the Inside View—Functional Block Diagram, Memory, Central Processing Unit, Memory-Mapped Input and Output, Clock Generator, Exceptions: Interrupts and Resets.

Text 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7. 11Hrs

UNIT – II

Architecture of the MSP430 Processor: Central Processing Unit, Addressing Modes, Constant Generator and Emulated Instructions, Instruction set, Examples , Reflections on the CPU and Instruction Set, Resets, Clock system.

Text 1: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8. 11 Hrs

UNIT – III

Interrupts and Low-Power Modes: Functions and Subroutines, Subroutine, Storage for Local Variables, Passing Parameters to a Subroutine and Returning a Result, Interrupts, Interrupt Service Routines, Issues Associated with Interrupts, Low-Power Modes of Operation.

Text 1: 6.1, 6.2, 6.3, 6.4, 6.6, 6.7, 6.8, 6.9, 6.10. 10 Hrs

UNIT – IV

Timers: Watchdog Timer, BasicTimer1, Timer_A, Measurement in the Capture Mode, Output in the Continuous Mode, Output in the Up Mode: Edge-Aligned Pulse-Width Modulation, Output in the Up/Down Mode: Centered Pulse-Width Modulation, Operation of Timer_Ain the Sampling Mode, Timer_B, Setting the Real-Time Clock: State Machines.

Text 1: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.9, 8.10, 8.11. **10 Hrs**

UNIT – V

Comparator A, Analog-to-Digital Conversion: General Issues, Analog-to-Digital Conversion: Successive Approximation, TheADC10 Successive-Approximation ADC, Basic Operation of theADC10, More Advanced Operation of theADC10, TheADC12 Successive-Approximation ADC.

Text 1 : 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7. **10 Hrs**

TEXT BOOKS:

1. **"MSP430 Microcontrollers Basics",** John Davies, Newnes (Elsevier Science), 2008.ISBN 978-0-7506-8276-3

REFERENCES:

1. ,**"Getting Started with the MSP430 Launchpad",** Adrian Fernandez, Dung Dang**,** Newnes (Elsevier Science), 2013.ISBN 978-0-124116009
2. **"Programmable Microcontrollers with Applications: MSP430 Launch Pad with CCS and Grace"** CemUnsalan, H. DenizGurhan, McGrawHillPublictions, 2013.ISBN 978-0071830034

Self learning components (SLC)

Unit-I	Study and understand the application of MSP430 in real time applications.
	Understand the environmental development to develop programs for microcontroller.
Unit-II	Light LEDs in C and Assembly Language.
	Access to the microcontroller for programming and debugging along with demonstration boards
Unit-III	Study of assembly language/ c-programming tools with programming exercises.
	Develop and Implement a assembly level program to Flash LEDs with frequency of 1Hz using software delay and subroutine.
Unit-IV	Study of Timer_A control registers .
	Design and develop a assembly level program to generate pseudorandom stream of bits using shift register.
Unit-V	Study and analyze architecture of Sigma-Delta ADC.
	Examine whether direct connection to a MSP430 is sufficient or further connection of the signal is required for conversions of analog signals to digital signals.

(Note: No questions set from SLC in the SEE paper)

D. Course Outcomes

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	**Apply** the knowledge of 8-bit processor to understand the 16-bit processor.	PO1[L1]
CO2	**Apply** the concepts of 8-bit processor to **analyze** instruction sets and other features in MSP430.	PO1,PO2[L2]
CO3	Discuss and **Analyze** the different peripheral components associated with MSP430.	PO2[L2]
CO4	To **develop** logical skills to write programs in MSP430 for the given Engg. Problems.	PO3[L3]
CO5	To **analyze** the developed code using modern engineering tools.	PO2, PO5[L3]

E. Course Articulation Matrix (CAM)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
#1	**2**												**3**	
#2	**2**	**3**												**3**
#3		**2**												**3**
#4			**2**										**3**	**2**
#5		**2**			**2**									**3**

A. Course Plan - Core			
Course Title: **Electromagnetic Field Theory**			
Course Code: **P17EC46**	Semester : **IV**	L-T-P: 4 – 0 - 0	Credits: 3
Contact Period : Lecture :52 Hr, Exam: 3Hr	Weight age:CIE:50% SEE:50%		

B. Course Learning Objectives (CLOs)

This course aims to

1. Provide the basic knowledge of electromagnetic fields and waves of radio communication.
2. Describe the basic laws, properties and equations of static electric field using 3–dimensional vector method.
3. Explain the current, conductor properties and boundary conditions
4. Understand the basic laws, properties and equations of static magnetic field using 3 – dimensional vector method.
5. Comprehend the Poisson's and Laplace's equations.
6. Analyse the concepts of magnetic forces and inductance.
7. Extend the Maxwell's equations to time varying electromagnetic waves.
8. Illustrate the properties of electromagnetic waves.
9. Explain the Plane Wave Reflection and Dispersion.
10. Give the concepts of electromagnetic wave propagation from transmitter to receiver.

C. Course Content

UNIT – I

Coulomb's Law and Electric Field Intensity: Experimental law of Coulomb, Electric field intensity, field due to continuous volume charge, line charge and sheet charge.

Electric Flux Density, Gauss's Law and Divergence: Electric flux density, Gauss law, application of Gauss Law, Divergence and divergence theorem

Text 1: 2.1 to 2.5, 3.1 to 3.7 **10 Hrs**

UNIT – II

Energy and Potential: Energy expended in moving a point charge in an electric field, line integral, definition of potential difference and potential, potential field of pointcharge and a system of charges, potential gradient, Dipole, energy density in an electric field,

Current and conductors: current and current density, continuity of current, conductors properties and boundary conditions, boundary conditions for perfect dielectric materials, capacitance.

Poisson's and Laplace's Equations: Poisson's and Laplace's equations, Uniqueness Theorem, examples of the solutions of Laplace's and Poisson's equations

Text 1: 4.1 to 4.8, 5.1, 5.2, 5.4, 6.2, 6.3, 7.1 to 7.4 **10 Hrs**

UNIT – III

The Steady Magnetic Field: Biot– Savart law, Ampere's circuital law, Curl, Stokes Theorem, magnetic flux and flux density, scalar and vector magnetic potentials.

Magnetic Forces and Inductance: Force on a moving charge and differential current element, force between differential current element, force and torque on closed circuit, magnetic boundary

conditions, potential energy and forces on magnetic materials, self-inductance and mutual-inductance

Text 1:8.1 to 8.6, 9.1 to 9.4, 9.7, 9.9, 9.10 **10 Hrs**

UNIT – IV

Time–Varying Fields and Maxwell's Equations: Faraday's law, displacement current, Maxwell's equations in point and integral form, retarded potentials.

The Uniform Plane Wave: Uniform plane wave, Wave propagation in free space and dielectrics, Poynting's vector and power considerations, propagation in good conductors(skin effect), Wave polarization

Plane Wave Reflection and Dispersion: Reflection of uniform plane waves at normal incidence, SWR, Plane wave Propagation in general directions.

Text 1: 10.1 to 10.5, 12.1 to 12.5, 13.1, 13.2 and 13.4 **11 Hrs**

UNIT – V

Ground Wave Propagation: Introduction, Space Wave and Surface Wave, Transition between Surface and Space Wave, Tilt of Wave Front due to Ground Losses, Earth's behavior at different frequencies.

Space Wave Propagation: Introduction, Field Strength Relation, Effects of Imperfect Earth, Effects of Curvature of Earth, Effects of Interference Zone, Shadowing Effect of Hills and Buildings, Super Refraction, Scattering Phenomena, Tropospheric Propagation, Fading, Path Loss Calculations.

Sky Wave Propagation: Introduction, Structural Details of the Ionosphere, Wave Propagation Mechanism, Refraction in The Absence of Earth's Magnetic Field, Refraction in the Presence of the Earth's Magnetic Field, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and the Skip Distance, Impact of Solar Activity,

Text 2:23.1, 23.3 to 23.5, 23.8,24.1 to 24.6, 24.9, 24.11 to24.14, 25.1 to 25.7 **11 Hrs**

TEXT BOOK:

1. **"Engineering Electromagnetics"**, William H. Hayt Jr. John A. Buck and M Jaleel AkhtarMcGraw–Hill, 8th edition, 2015. ISBN: 9789339203276
2. **"Antennas and Wave Propagation",** John D Kraus, Ronald J Marhefka and Ahmed S Khan, Tata McGraw Hill, 4th Edition, 2015. ISBN: 9780070671553

REFERENCE BOOKS:

1. **"Electromagnetics with Application"** ,John Kraus and Daniel .A. Fleischer, McGraw Hill, 5th edition 1999. ISBN: 9780071164290
2. **"Electromagnetics",**Joseph A Edminister, Adapted by: Vishnu priye. McGraw–Hill, Revised 2nd edition, 2013. ISBN:9780070353961
3. **"Electromagnetic Concepts and Applications",** Richard E. Dubroff. Stanley V. Marshall. Gabrile G. Skiter Pearson Education 4th Edition. 2016. ISBN: 978-0133011517

Self-Learning Component

1. Vector algebra, Co-ordinate systems – Cartesian, Cylindrical and Spherical.
2. Solve the Problems in text book for the following using MATLAB:
    - Surface and volume integrals
    - Electric field intensity, Electric flux density
    - Electric potential, current
    - Boundary conditions, capacitance
    - Laplace equations
    - Magnetic field
    - Self and mutual inductance
3. Wave reflection from multiple interfaces, Plane wave reflection at oblique
4. Basics of wave propagation,Multi-Hop propagation
5. Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC)

D. Course Outcome

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	**Apply** the knowledge of physics and Vector calculus to understand EM fields and waves.	PO1(L3)
CO2	**Analyse** Electric and magnetic fields and waves and its effect in various charge distribution of medium.	PO1, PO2(L4)
CO3	**Compute** the electric and magnetic field potentials due to different charge distributions and boundary conditions.	PO2, PO3(L3)
CO4	**Analyze** time-varying electromagnetic fields and waves as governed by Maxwell's equations.	PO2(L4)
CO5	**Examine** the effects and losses of medium on wave and various parameters influencing wave propagation	PO1, PO2(L4)

E. Course Articulation Matrix (CAM)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
#1	**3**												**3**	
#2	**2**	**3**											**2**	**3**
#3		**2**	**3**											**2**
#4		**3**												**3**
#5	**3**	**2**											**3**	**2**

A. Course Plan			
Course Title: **Microcontroller Laboratory**			
Course Code: **P17ECL47**	Semester: **IV**	L – T – P : 0 – 0 - 3	Credits: 1.5
Contact Period - Lab: 36 Hrs.; Exam: 3 Hrs.	Weightage: CIE: 50 %;		SEE: 50%

B. Course Learning Objectives

This course aims to

1. Familiarize usage of different classes of instruction usage in programming
2. Practicing of verity of code conversion popularly used in embedded system
3. Familiarize display interfacing to the processor
4. Understand and perform measurement of pressure, temperature and weight
5. Learn utilization of on chip peripherals for practical applications.
6. Familiarize usage of serial communication protocol for different application
7. Learn generation of different waveforms.

C. Course Content

List of experiments

Software experiments:

1. Data transfer- Block move and exchange, sorting, finding largest element in an array, Arithmetic instructions- Addition, Subtraction, multiplication, division, incrementing, decrementing operations.
2. Boolean and logical instructions: AND, OR, XOR, NOT, rotate and swap operations, Conditional CALL and RETURN
3. Code conversion: BCD to ASCII, ASCII-decimal, decimal to ASCII, Hex to Decimal, Decimal to Hexadecimal, Binary to decimal, Hexadecimal to ASCII.

Interfacing experiments:

4. Program to blink the LED's using on-chip timer.
5. Interfacing an LCD unit to MSP430F2013.
6. Measurement of pressure, temperature, weight
7. Temperature monitoring system.
8. Generation of different waveforms using DAC interface.
9. Stepper motor interface and speed control of DC motor interface using PWM.
10. Measurement of time and frequency using timers and interrupts.
11. Serial Data communication.
12. Relaxation oscillator with comparator

Open ended experiment

1. Write a program to count the number of vehicle passed on road. Get athe input from relevant sensor and perform the operation.
2. Design a circuit to control wiper of truck on sensing rain(wet condition).The wiper at driver should rotate 95^0 and at co-passenger 128^0

D. Course outcomes

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	**Develop** assembly language programs for MSP430	P03
CO2	**Verify** Assembly language programs using **IAR Embedded Test bench**	PO1, P05
CO3	**Interface hardware modules** to F2013 and **develop** interfacing programs in C Programming language	PO3, PO5
CO4	**Independently** develop assembly programs in MSP430 for the given problem	PO3, PO9

E. Course Articulation Matrix (CAM)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
#1			**3**											**3**
#2	**1**				**3**								**1**	
#3			**3**		**2**									**3**
#4			**3**											**3**

A. Course Plan			
Course Title : **Digital Design Using Verilog HDL Laboratory**			
Course Code: **P17ECL48**	Semester : **IV**	L-T-P: 0 – 0 – 1.5	Credits: 1.5
Contact Period : Lecture :36 Hr, Exam: 3Hr	Weightage :CIE:50% SEE:50%		

B. Course Learning Objectives (CLOs)

This course aims to

1. Provide the basic knowledge of how to use Xilinx tool and Vivado
2. Execute the Verilog code to realize all basic gates.
3. Execute the Verilog code for combinational logic circuit and sequential circuits.
4. Execute the Verilog code to describe the functions of a Full Adder and 4 bit binary serial adder.
5. Develop the Verilog algorithm for 8 bit Multiplier using booth multiplier.
6. Develop the Verilog code to interface seven segment display and LCD and accepting the hex key pad.
7. Develop the Verilog code to interface of DC and Stepper motor.
8. Develop the Verilog code to generate different waveforms using DAC.

9. Develop the Verilog code to simulate Elevator operations.
10. Develop the Verilog code to control external lights using relays.

C. Course Content

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/ Acex/ Max/ Spartan/ Sinfi/ TK Base or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/ Modelsim or equivalent.

Experiments: Programming (Using Verilog only)

1. Write verilog HDL code to realize all the logic gates.
2. Write a verilog HDL program for the following combinational designs
    a. Decoder
    b. Encoder (without priority & with priority)
    c. Multiplexer and Demultiplexer
    d. Code converter.
    e. Comparator.
3. Write a VERILOG HDL code to describe the functions of a Full Adder, parallel adder and subtractor using three Modeling styles.
4. Develop and simulate a VERILOG HDL code for 8 bit booth Multiplier.
5. Develop the VERILOG HDL code for the following flip– flops, SR, D, JK, T and counter.
6. Design and develop VERILOG HDL code for a 4 bit binary serial adder and simulate.

Experiments: Interfacing

(At least four of the following must be covered using Verilog HDL only)

1. Write VERILOG HDL code to display messages on the given seven segment display and LCD and accepting Hex key pad input data.
2. Write VERILOG HDL code to control speed, direction of DC and Stepper motor.
3. Write VERILOG HDL code to accept 8 channel Analog signals, Temperature sensors and display the data on LCD panel or seven segment display.
4. Write VERILOG HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC change the frequency and amplitude.
5. Write VERILOG HDL code to simulate Elevator operations.
6. Write VERILOG HDL code to control external lights using relays.

Open-end Experiments:

To write the VERILOG HDL code for IC 74X189—read and write operations of RAM.
To write the VERILOG HDL code for Finite State Machine (FSM) based Design (MOORE and MEALY).

D. Course Outcome (CO)

CO #	Course Outcome	Program Outcome Addressed (PO #) with BTL
CO1	Develop the Verilog code for all combinational logic and sequential circuits.	PO3,L1
CO2	Analyze the waveforms of various flip– flops and write Verilog code for it.	PO1,PO2,l4
CO3	Design the synchronous and asynchronous counter using Verilog Code.	PO3,L5
CO4	Implement the Interfacing of DC , Stepper motor, seven segment display, LCD, DAC and Hex key pad to FPGA kit using modern tool	PO1,PO2,PO3,PO5,L3

E. Course Articulation Matrix (CAM)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
#1			**3**											**3**
#2	**3**	**2**											**3**	**2**
#3			**3**										**3**	**3**
#4	**3**	**3**	**2**		**3**								**3**	**3**

Course Title : Aptitude and Reasoning Development - Intermediate (ARDI)			
Course Code : P17HU49	Semester : IV	L - T - P : 2-0 - 0 - 2	Credits: 01
Contact Period: Lecture: 32 Hr, Exam: 3 Hr	Weightage: CIE:50%;SEE:50%		

Prerequisites: ARDB

Course Learning Objectives (CLOs)

This course aims to

1. Explain proportionality rule, average speed, relative speed and concepts in circular track.
2. Explain the application of time, speed distance in solving problems related to races, trains, boats and streams, and clocks.
3. Explain different methods to calculate number of smaller cubes, the date and the day of any year and the concepts of clocks.
4. Explain the methodology of strengthening or weakening the given statement.
5. Explain application of Venn diagrams in solving set theory problems.
6. Explains the concept of syllogism and provides the methodology to tackle the problems.
7. Describes all the important properties of triangle, polygons, circle and other geometrical

figures and solve application based questions.
8. Describe the properties of cone, cylinder, sphere, cube and cuboid and solve the application based questions.
9. Differentiates between individual work and group work.
10. Integrates the concept of individual work in solving problems related to pipes and cisterns

Relevance of the course:
4th semester deals with more of quantitative aptitude. It is the intermediate level of aptitude which involves modules like Time speed distance. Time and work, set theory. This course also touches upon logical abilities through modules like cubes and Calendars.

Course Content

Unit – I

Time, Speed and Distance:
Concept of motion and mathematical representation of motion, The rule of proportionality, Conversion between kmph to m/s, Concept of average speed and its application in different scenarios, Relative speed– Importance, application and observation in day to day life, same direction and opposite direction, An application of allegation in Time speed and distance, Trains– Different scenarios. Boats and streams– resultant speed, upstream and downstream concept. Circular motion– Two or three bodies meeting at the starting point or anywhere in the track. Races– Concept of head start, solving problems under different constraints. Application of solving problems under Clocks.
SSC: Basic relation between the 3 different quantities. Conversions between different units of measurement. Speed and velocity. **6 Hrs**

Unit – II

Cubes, Clocks & Calendars:
Cubes: Number of faces, vertices and edges. Colored cubes. Number of colored faces and the formulae to find-out the same. Problems on cubes.
Clocks & Calendars: Minute spaces. Hour hand and minute hand. Angle between the hands. Relative speed. Faulty clocks. Time gained or lost by the clock. Odd days. Leap year. Ordinary year. Counting of odd days. Problems on clocks and calendars.
Self-study Component- Knowledge about shapes and dimensions, Area and volume. Leap year, number of days. Important dates. **8 Hrs**

Unit – III

Set theory and Venn diagram: Set builder form, Tabular form, Venn diagram, Types of sets, Operation of sets using venn diagram, Important properties, Algebraic laws of sets, Maxima and minima in set operation, Venn diagram for four sets.
Syllogism: Meaning of syllogisms, Format of problems and standard qualifiers, Concept of distribution, Standard question pattern, Application of venn diagram to solve problems. **Logical Venn diagrams:** Analysis of the given problem and solve it.

Self-study Component- Basics about sets, operations using venn diagram. Basic applications. **6 Hrs**

Unit – IV

Geometry and Mensuration:

Theory, straight lines, triangles– theorems, area, lines inside triangle and geometric centre, Special property of an equilateral triangle, Application of Pythagoras theorem, Congruency and similarity of triangles, Basic proportionality theorem, Polygons, Quadrilaterals, Trapezium, Parallelogram, Rectangle, Rhombus, Square, Division of polygons, Circumscribed and Inscribed polygons, Concyclic points concept, Cyclic quadrilateral, Circle– Radius, Area and perimeter, Arc, Chord, Sector, Segment, Tangent, Secant, Area of common region Solid figures– Introduction, Classification of a solid, Net of a solid, Cuboid, Cube, Right cylinder, Pyramid– right pyramid, triangular pyramid, Cone– frustum of a cone, Sphere, Combination of solid.

Co-ordinate geometry:

Cartesian coordinate geometry– rectangular coordinate axis, distance formula, Section formula, Area of a triangle, Centre of gravity or Centroid of a triangle, In-centre of a triangle, Circumcentre of a triangle, Orthocentre of a triangle, Collinearity of three points, Slope of a line, Different forms of equations of a straight line, Perpendicularity and parallelism, Length of perpendicular.

Self-study Component-Basics of geometry, formula, dimensions, shapes. Different types of lines. Example – parallel, intersecting etc… **8 Hrs**

Unit – V

Time and Work:

Relationship between time and work. Importance of efficiency, Conventional method of solving problems, L.C.M method, Negative work, The specific case of building a wall, Group work, Constant product rule, When work is not constant, Pipes and cistern– Similarity of logic.

SSC: LCM methods, basic arithmetic. Fractions and efficiency. **4 Hrs**

Reference Books:

1. The Trachtenberg speed system of basic mathematics, published by Rupa publications.
2. CAT Mathematics by AbhijithGuha. published by PHI learning private limited.
3. Quantitative aptitude by Dr. R. S Agarwal, published by S.Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal , published by S. Chand private limited.
5. Quantitative aptitude for CAT by Arun Sharma, published by McGraw Hill publication.
6. Analytical reasoning by M.K Pandey BSC PUBLISHING.CO.PVT.LTD

Course Outcomes (CO)

After learning all the units of the course, the student is able to:

1. Solve problems of higher difficulty level with ease in the following topics– Time , speed and distance and Geometry. L5
2. Analyze the number of colored faces in a cube when it is cut into different number of pieces and solve the problems under clocks and calendars. L5
3. Apply the concept of L.C.M in the module time and work to solve the problems with comprehension. L2
4. Analyze the concepts in Co-ordinate geometry by spatial visualization. L4
5. Interpret the logic in the statements of syllogism by critical thinking and apply venn diagram for the effectives ways of deriving at the conclusion. L4
6. Determine the solutions for complicated problems of set theory using the concept of venn diagram. L4

Course Articulation Matrix															
Course Outcomes		Program Outcomes												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	Solve problems of higher difficulty level with ease in the following topics– Time, speed and distance and Geometry.	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	-
CO2	Analyze the number of colored faces in a cube when it is cut into different number of pieces and solve the problems under clocks and calendars.	**-**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	-
CO3	Apply the concept of L.C.M in the module time and work to solve the problems with comprehension.	**-**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	-	-
CO4	Analyze the concepts in Co-ordinate geometry by spatial visualization.	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	-
CO5	Interpret the logic in the statements of syllogism by critical thinking and apply venn diagram for the effective's ways of deriving at the conclusion.	**-**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	-	-
CO6	Determine the solutions for complicated problems of set theory using the concept of venn diagram.	**-**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**-**	-	-

Course Title : Additional Mathematics-II			
Course Code : P17MADIP41	Semester : 4	L :T:P:H : 4:0:0:4	Credits: 0
Contact Period: Lecture: 52 Hr, Exam: 3 Hr		Weightage: CIE:50%, SEE:50%	

((Mandatory Learning Course: **Common to All Branches)**
(A Bridge course for Diploma qualified students of IV Sem. B. E.)

Course Content

UNIT –I

Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form of a matrix. Consistency of system of linear equations - Gauss elimination method. Gauss-Jordan and LU decomposition methods. Eigen values and eigen vectors of a square matrix. Application of Cayley-Hamilton theorem(without proof) to compute the inverse of a matrix-Examples.

10 Hrs

UNIT –II

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. Solution of Cauchy's homogeneous linear equation and Legendre's linear differential equation. **14 Hrs**

UNIT –III

Multiple Integrals: Double and triple integrals-region of integration. Evaluation of double integrals by change of order of integration.

Vector Integration : Vector Integration :Integration of vector functions. Concept of a line integrals, surface and volume integrals. Green's, Stokes's and Gauss theorems (without proof) problems. Orthogonal curvilinear coordinates. **10 Hrs**

UNIT –IV

Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals**,** transforms of periodic function and unit step function-Problems only. 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. **12 Hrs**

UNIT –V

Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. Bayes's theorem-examples. **06 Hrs**

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi,42nd Ed. 2012.

References:

1.E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 6th Ed., 2007
2.N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers,7th Ed., 2007.